COMPUTING FOR BUSINESS AND HOME

INTERFACE AGE™

SEPTEMBER 1981 $2.50/CANADA/MEXICO $3.00

6/9

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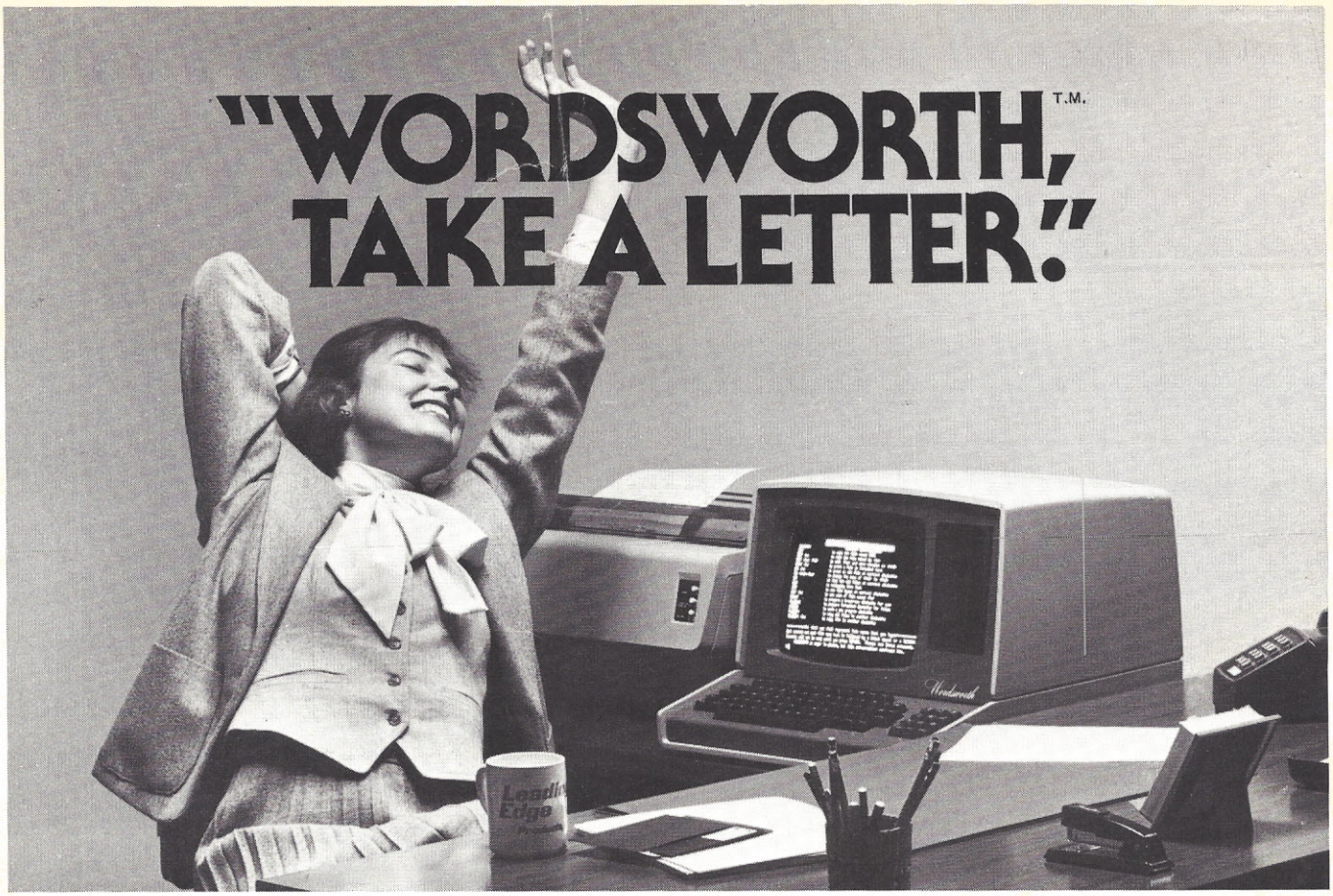

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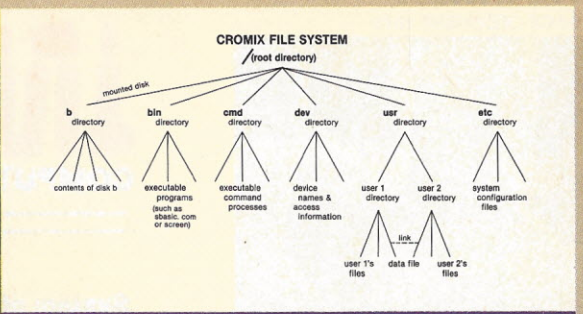

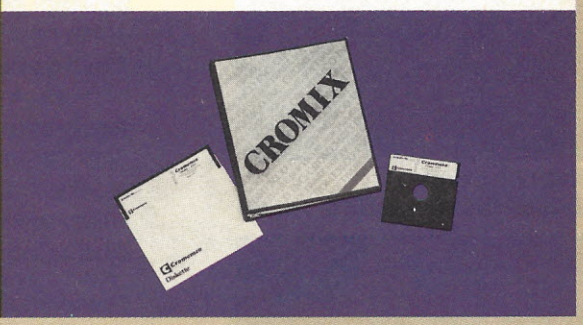

CROMIX*— Cromemco's outstanding UNIX†–like operating system

CROMIX is just the kind of major development you've come to expect from Cromemco. After all, we're already well-known for the most respected software in the microcomputer field.

And now we've come up with the industry's first UNIX-lookalike for microcomputers. It's a tried and proven operating system. It's available on both 5" and 8" diskettes for Cromemco systems with 128K or more of memory.

Here are just some of the features you get in this powerful Cromemco system:

- Multi-user and multi-tasking capability
- Hierarchical directories
- Completely compatible file, device, and interprocess I/O
- Extensive subsystem support

FILE SYSTEM

One of the important features of our CROMIX is its file system comprised of hierarchical directories. It's a tree structure of three types of files: data files, directories, and device files. File, device, and interprocess I/O are compatible among these file types (input and output may be redirected interchangeably from and to any source or destination).

The tree structure allows different directories to be maintained for different users or functions with no chance of conflict.

PROTECTED FILES

Because of the hierarchical structure of the file system, CROMIX maintains separate ownership of every file and directory. All files can thus be protected from access by other users of the system. In fact, each file is protected by **four separate access privileges** in each of the three user categories.

TREMENDOUS ADDRESS SPACE, FAST ACCESS

The flexible file system and generalized disk structure of CROMIX give a disk address space in excess of one gigabyte per volume — file size is limited only by available disk capacity.

Speed of access to disk files has also been optimized. Average access speeds far surpass any yet implemented on microcomputers.

'C' COMPILER AVAILABLE, TOO

Cromemco offers a wide range of languages that operate under CROMIX. These include a high-level command process language and extensive subsystem support such as COBOL, FORTRAN IV, RATFOR, LISP, and 32K and 16K BASICs.

There is even our highly-acclaimed 'C' compiler which allows a programmer fingertip access to CROMIX system calls.

THE STANDARD O-S FOR THE FUTURE

The power and breadth of its features make CROMIX the standard for the next generation of microcomputer operating systems.

And yet it is available for a surprisingly low $595.

The thing to do is to get all this capability working for you now. Get in touch with your Cromemco rep today.

*CROMIX is a trademark of Cromemco, Inc.
†UNIX is a trademark of Bell Telephone Laboratories

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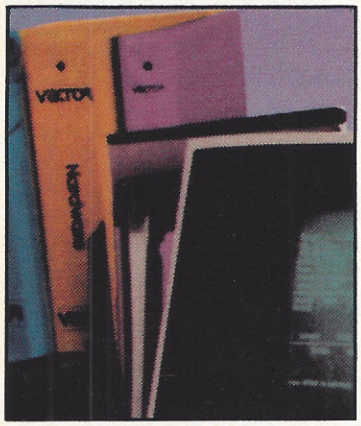
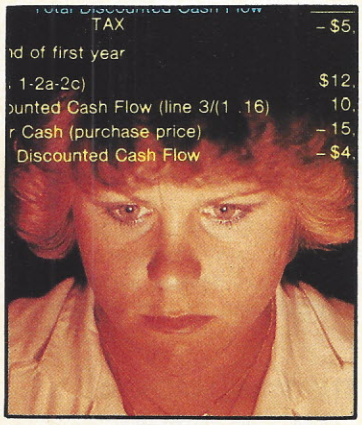
INTERFACE AGE™

COMPUTING FOR BUSINESS AND HOME APPLICATIONS

Heart II: Risk Evaluation Revisited . . . 66



Choosing a Medical Office Computer 70



Programming Equipment Purchase Options 74

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FEATURES

COLUMNS

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Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701 in care of their respective columns.

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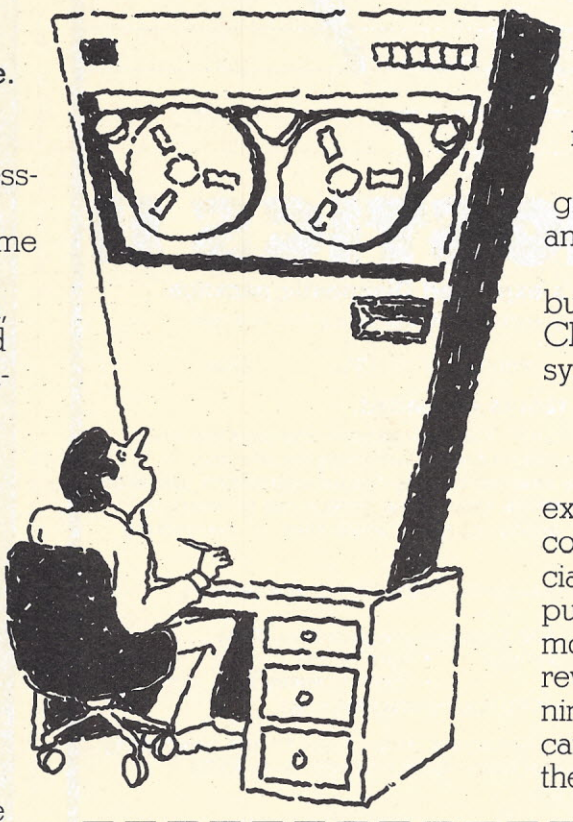

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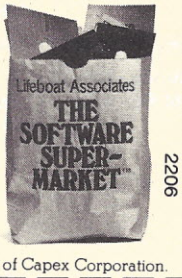

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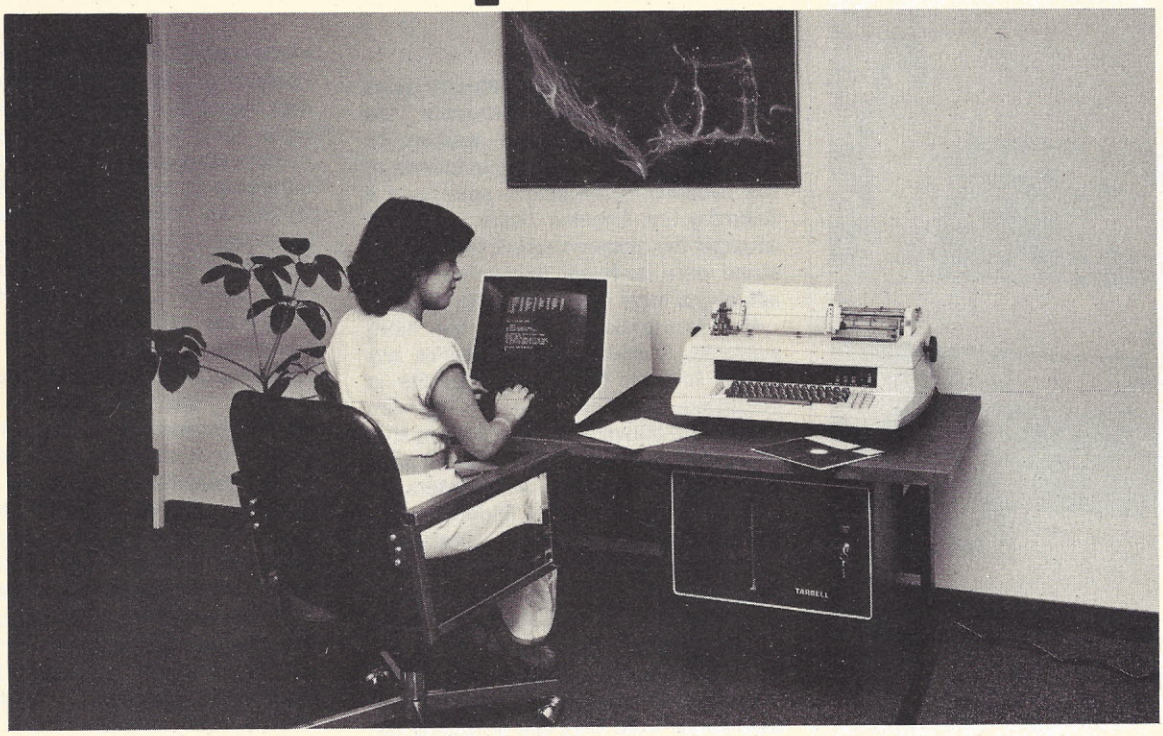

The Serious Business Machine

Do you have a small computer system that operates with mini-floppies and has limited storage capacity? Then it's time to move up to the Tarbell Empire Series System. Tarbell starts where small systems leave off, providing storage from 1 to 20 megabytes. This means Tarbell is capable of growing right along with your business. (It also makes sense to start with Tarbell if you're a first-time computer buyer.)

Tarbell is the serious general purpose business machine, backed by years of experience with disk systems. It gives you word processing, inventory control with bill of materials, mailing lists — all in addition to accounting applications: general ledger, payables, receivables, payroll with cost accounting and order entry. Whatever your need may be, Tarbell can provide the working software that gets the job done.

With the Tarbell System you get a Z80 4 Mhz CPU with memory management, timer and full interrupt capability, 2 RS-232 serial ports with handshaking, 64 K bytes of random-access memory, double density floppy disk interface, 2 double density floppy disk drives, cabinet, power supply, and cables.

The software includes: CP/M™ 2.2 disk operating system, Tarbell Disk BASIC, Tarbell Database System, and all manuals and documentation.

Tarbell also offers the MP/M™ Multi-User Operating System and 4 additional RS-232 serial ports.

The Tarbell Empire Series is delivered assembled, tested, and with a FULL six-month warranty on parts and labor.

And when you need even more mass storage, Tarbell also has a hard disk that's system-compatible and provides easy back-up.

If your business is growing or you need more than a few hundred K bytes — it's time to move up to Tarbell. Call your local Tarbell dealer for competitive prices.

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EDITOR'S NOTEBOOK

Don't pass the buck

As the microcomputer industry gains in its maturity, the products are becoming more and more available to the general public. We saw evidence of this recently in the sports section of a Saturday Los Angeles *Times*. Sprinkled amongst the gloomy news of the baseball strike were no fewer than ten different ads about local microcomputer stores.

But just because micros are more available, it doesn't mean they're any easier to buy. Quite the opposite is occurring, in fact. One of the ads mentioned above was from a store that deals exclusively in canned micro software; another handles *only* printers for micros. It takes a lot of knowledge on the part of the shopper to assemble a computer system from components purchased all over town. As computer sales personnel become more and more knowledgeable about their products, there is a creeping assumption that the purchasers, as well, should have a good idea about what they are shopping for. The burden of knowledge is shifting, ever so subtly, onto the shoulders of the end user. It's an unfair situation, really. Unfair because most prospects for business-class micros received their formal schooling in an era when computers were not a part of the curriculum. We had to learn on our own, from night classes, reading computer magazines or suffering with a wrong computer purchase.

We recently received a call from a would-be microcomputer owner who was typically intimidated by the mass of unfamiliar knowledge needed to select just the right computer for a business application. The proprietress of a wildly successful retail store in the Washington, D.C. area, the caller was convinced that a computer was necessary to keep track of her out-of-control inventory situation.

This business person did all the right things: visited the local computer stores, attended "educational" seminars put on by giant computer corporations, asked friends about their experiences—in short, she "shopped the field," something we recommend heartily. After some weeks, our caller realized that the time and attention being expended in learning this new field was cutting into the essential management activities which made the business a success in the first place. She wanted to hire an expert; a knowledgeable consultant to select the computer to solve the inventory problem. There's nothing wrong with this; it's being done a lot these days.

We began to get worried, however, when our caller stated that she wanted "someone to take all the responsibility—pick the hardware and software, make it work, keep it running—so I won't have to learn anything new." We can see the attraction of divorcing oneself form the mysterious problems associated with an unfamiliar piece of machinery; but we also firmly believe that the attitude is short-sighted and, in the long run, hazardous to the health of the computerized business.

We suggested an alternative attitude: Consider the computer to be just another business machine, a tool that's needed to run the operation. A machine like a typewriter or copier. As such, the owner has the responsibility to learn at least the fundamentals of using the equipment—even of performing a little light maintenance when necessary. If a business did not have a person trained in replenishing the supplies in the office copier—or clearing a paper jam—that machine would soon become an expensive burden instead of the valuable business tool it is designed to be. If a high-priced expert had to be called in to perform these specialized (but fundamentally simple) duties, the equipment could hardly be cost-justified. Every office with a copier needs a "key operator," one who has been trained in the special needs of the device. The same is true of computers. You should *not* take short cuts in this area.

—TF

Report from Chicago CES

Introductions of actual computers at the recent Consumer Electronics Show in Chicago were dwarfed by the enormous volume of products, but a good number of new systems were on display.

Casio showed a wide range of units ranging in price from $200—$1,000. The inexpensive FX-602P is a versatile programmable scientific calculator with 512-step program memory, full program editing and alphanumeric capability. The moderately priced FX-702P is a full-fledged handheld computer similar in many respects to the Radio Shack unit. The most expensive of the lot, the FX-9000P is a tabletop model with slot-in memory capsules and a built-in video screen.

Panasonic announced imminent marketing for its long-awaited RL-H1000 handheld computer, which has been improved and will be available with a wide range of peripherals. On display at parent company Matsushita's Technology Today exhibit were two business computers—one sporting a unique keyboard with literally thousands of fully

COMPUSTAR™

INTERTEC'S INCREDIBLE 255 USER SMALL BUSINESS COMPUTER

At last, there's a multi-user microcomputer system designed and built the way it should be. The CompuStar™. Our new, low-cost "shared-disk" multi-user system with mainframe performance.

Unlike any other system, our new CompuStar offers what we believe to be the most practical approach to almost any multi-user application. Data entry. Distributed processing. Small business. Scientific. Whatever! And never before has such powerful performance been available at such modest cost. Here's how we did it . . .

The system architecture of the CompuStar is based on four types of video display terminals, each of which can be connected into an auxiliary hard disk storage system. Up to 255 terminals can be connected into a single network! Each terminal (called a Video Processing Unit) contains its own microprocessor and 64K of dynamic RAM. The result? Lightning fast program execution! Even when all users are on-line performing different tasks! A special "multiplexor" in the CompuStar Disk Storage System ties all external users together to "share" the system's disk resources. So, no single user ever need wait on another. An exciting concept . . . with some awesome application possibilities!

CompuStar™ user stations can be configured in almost as many ways as you can imagine. The wide variety of terminals offered gives you the flexibility and versatility you've always wanted (but never had) in a multi-user system. The CompuStar Model 10 is a programmable, intelligent terminal with 64K of RAM. It's a real workhorse if your requirement is a data entry or inquiry/response application. And if your terminal needs are more sophisticated, select either the CompuStar Model 20, 30 or 40. Each can be used as either a stand-alone workstation or tied into a multi-user network. The Model 20 incorporates all of the features of the Model 10 with the addition of two, double-density mini-floppies built right in. And it boasts over 350,000 bytes of local, off-line user storage. The Model 30 also features a dual drive system but offers over 700,000 bytes of disk storage. And, the Model 40 boasts nearly 1½ million bytes of dual disk storage. But no matter which model you select, you'll enjoy unparalleled versatility in configuring your multi-user network.

Add as many terminals as you like - at prices starting at less than $2500. Now that's truly incredible!

No matter what your application, the CompuStar can handle it! Three disk storage options are available. A tabletop 10 megabyte 8" winchester-type drive complete with power supply and our special controller and multiplexor costs just $4995. Or, if your disk storage needs are more demanding, select either a 32 or 96 megabyte Control Data CMD drive with a 16 megabyte removable, top loading cartridge. Plus, there's no fuss in getting a CompuStar system up and running. Just plug in a Video Processing Unit and you're ready to go . . . with up to 254 more terminals in the network by simply connecting them together in a "daisy-chain" fashion. CompuStar's special parallel interface allows for system cable lengths of up to one mile . . . with data transfer rates of 1.6 million BPS!

Software costs are low, too. CompuStar's disk operating system is the industry standard CP/M*. With an impressive array of application software already available and several communication packages offered, the CompuStar can tackle even your most difficult programming tasks.

Compare for yourself. Of all the microcomputer-based multi-user systems available today, we know of only one which offers exactly what you need and should expect. Exceptional value and upward growth capability. The CompuStar™. A true price and performance leader!

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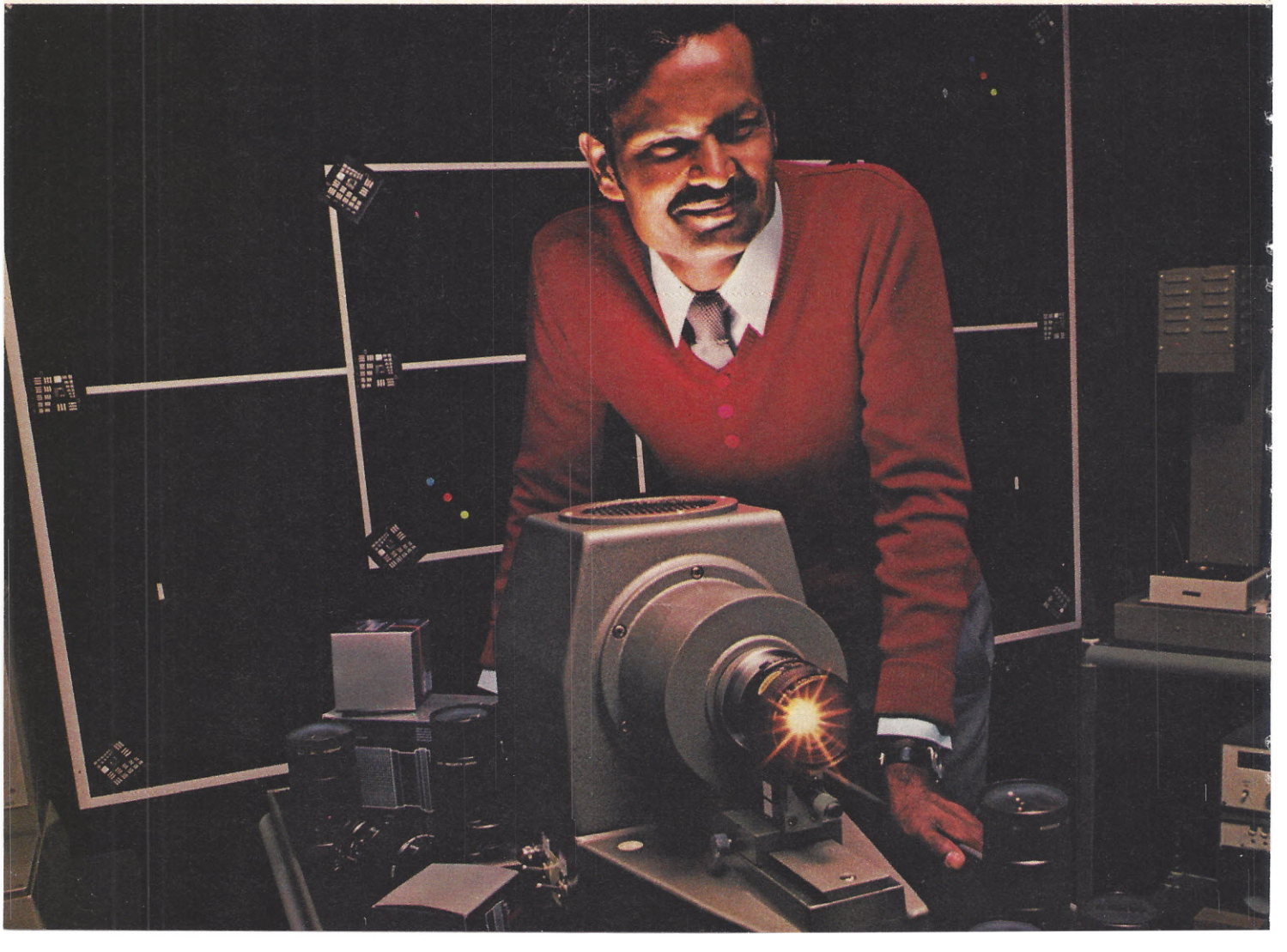
Reddy Chirra improves his vision with an Apple.

Reddy is an optical engineer who's used to working for big companies and using big mainframes.

But when he started his own consulting business, he soon learned how costly mainframe time can be. So he bought himself a 48K Apple II Personal Computer.

And, like thousands of other engineers



and scientists, quickly learned the pleasures of cutting down on shared time and having his own tamper-proof data base.

His Apple can handle formulas with up to 80 variables and test parameters on 250 different optical glasses.

He can even use BASIC, FORTRAN, Pascal and Assembly languages.

And Apple's HI-RES graphics come in handy for design.

Reddy looked at other microcomputers, but chose Apple for its in-depth documentation, reliability and expandability.

You can get up to 64K RAM in an Apple II. Up to 128K RAM in our new Apple III. And there's a whole family of compatible peripherals, including an IEEE-488 bus for laboratory instrument control.

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RS-232C Compatible. Smartmodem lets any RS-232C compatible computer or terminal communicate by phone with other computers and time-sharing systems located *anywhere in North America*. You get full and half-duplex operation with both Touch-Tone* *and* pulse dialing.

Auto-Answer/Dial/Repeat. Smartmodem can answer the phone, dial a number, receive and transmit data, and then hang up the phone— automatically! If desired, Smartmodem will even repeat the last command. You can depend on Smartmodem for completely unattended operation.

Completely Programmable. Smartmodem can be controlled using *any* programming language. Over 30 different commands can be written into your programs or entered directly from your keyboard.

Smartmodem also includes several switch-selectable features that let you tailor performance to your exact needs. You can "set it and forget it" for the ultimate in convenience.

Built-in Audio Monitor. Thanks to an internal speaker, you can actually listen to your connection being made. You'll know immediately if the line is busy or if you reached a wrong number— *and you don't even need a phone!*

Status at a Glance. Seven LED's indicate Smartmodem's current operating mode: auto-answer, carrier detect, off hook, receive data, send data, terminal ready and modem ready. You're never left in the dark!

Direct-Connect Design. Smartmodem is FCC registered for direct connection to any modular phone jack— there's no acoustic coupler to cause signal loss and distortion.

Smartmodem, Smart Buy. Professional quality features. Versatile performance. A full two-year limited warranty. A suggested retail price of only $279.

What more could you want? Perhaps the matching Hayes Stack Chronograph, an RS-232C compatible calendar/clock system.

Check out the Smartmodem wherever fine computer products are sold. And don't settle for anything less than Hayes.

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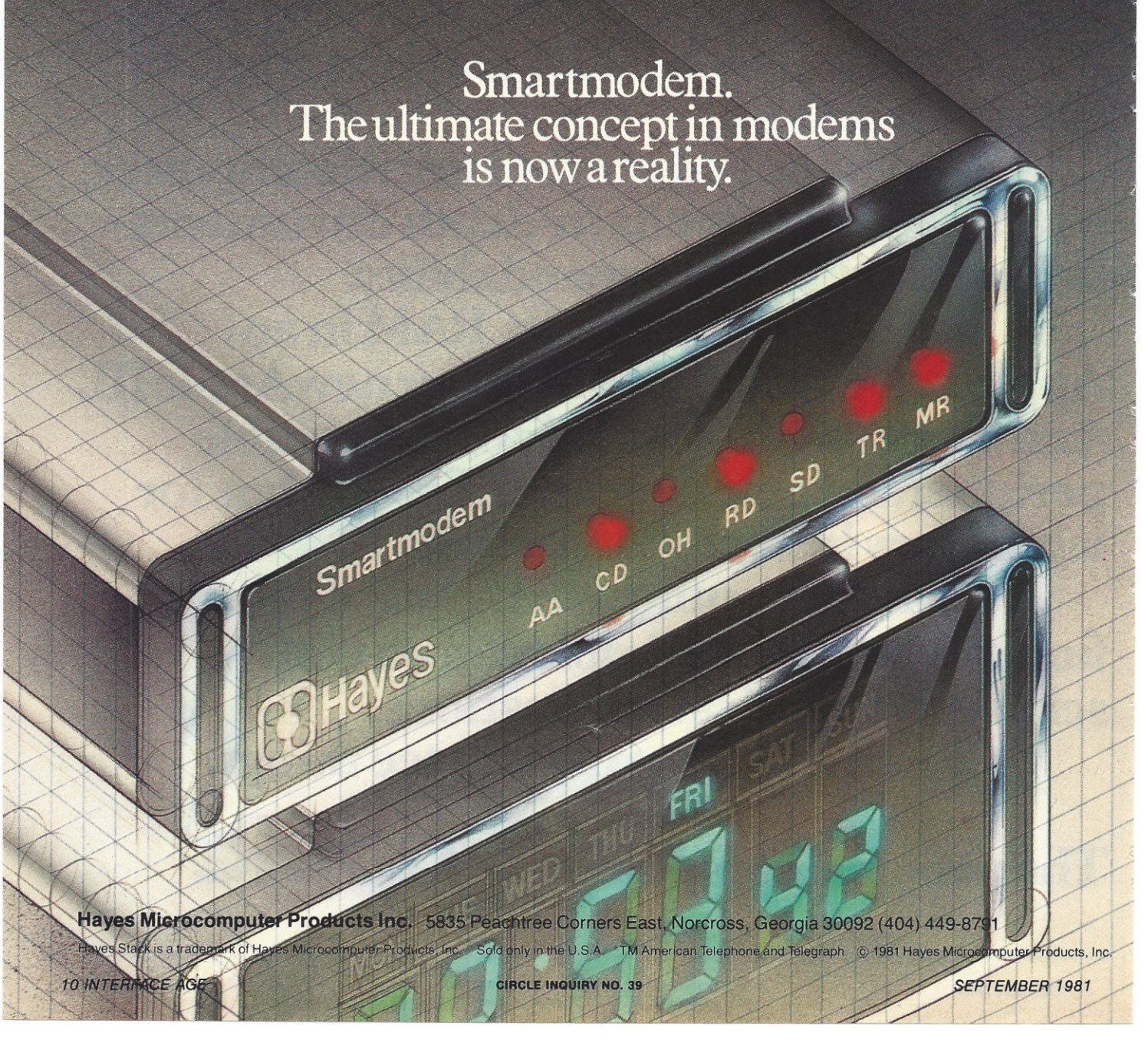
Smartmodem. The ultimate concept in modems is now a reality.



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programmable keys—plus a pocketable portable data terminal and a very fast inkjet printer that reproduces in full color whatever is on the visual display of an attached computer.

NEC showed a full line of computer products including the PC-8001A personal tabletop computer, PC-8012A I/O unit that can expand the memory to 160K RAM, the PC-8013A dual minifloppy disk drive, and the JB-1201M 12-in. greenscreen monitor.

Hewlett-Packard demonstrated its HP-83A ("System of the Month" IA May 81), a less expensive version of the HP-85A lacking printer and tape deck. The company was also demonstrating its bar code system, which has been adopted by Matsushita for use in certain prototypes.

Maxell, the well known magnetic recording tape marketer, showed a full line of magnetic disks including mini and full size, hard and soft sectored, and single and double density varieties.

Commodore, aggressively pursuing the low-end digital watch market Texas Instruments abandoned, still had time to formally introduce the VIC-20 color personal tabletop computer—and to announce a full range of peripherals for the new mass marketable computer.

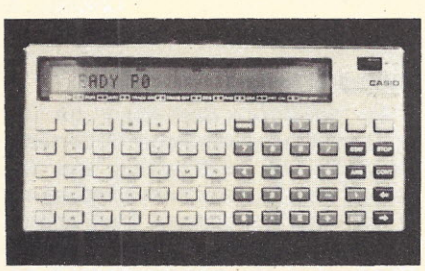
Texas Instruments had no new computers, instead displaying its ever-cheaper TI-99/4.

Sinclair announced the ZX-81, an improved version of the popular $200 ZX-80, and a $100-odd flatscreen pocket TV, and hinted at the possibility of a pocket combo unit with computer and flatscreen TV.

Perhaps the most exciting new product actually ready for sale at the show was Votrax's Type'N'Talk, a $350 device that faithfully articulates data into intelligible spoken English. Type'N'Talk is claimed to have an unlimited vocabulary.

The real action at the show in computers was, however, in microprocessor-based products. Such marvels as equalizers that automatically tune hi-fi systems for specific rooms and talking clock radios were displayed.

—David Civan



Casio FX-702P handheld computer

LETTERS

Cross-check

Some readers have had problems adapting my cross-reference program (IA Jun 81) to run on the TRS-80 model III. The problem results from my using a back-slash character ("\") to terminate the list of reserved words.

For some reason, this character is absent from the TRS-80 keyboard. So the temptation is for the TRS-80 owner to blithely substitute a forward-slash ("/") for the back-slash in lines 250 and 310. Unfortunately, it is necessary that the last element in the reserved word array has an ASCII value greater than Z. Otherwise, the test for reserved words in lines 900 and 910 may continue past the end of the array. Hence the mysterious "ILLEGAL FUNCTION CALL IN LINE 900". (Taking the ASC value of a null string is a definite no-no.)

One fix for this problem is to substitute a left bracket, "[", right bracket, "]", or caret "^", in place of the back-slash in lines 250 and 310. Should your keyboard be so rinky-dink as to lack all of these characters, then use the forward slash but insert a new line as follows:

```
365 RW$(RW) = CHR$(255)
      'TERMINATE RESERVED
      WORD ARRAY
```

The test for non-existent files is only a frill. If your Basic does not accept line 70 (ON ERROR GOTO 1480), delete it, as well as line 440 and lines 1480 through 1500.

Don't add any special characters, such as @ to the list of reserved words. The @ should be treated correctly without any program changes.

If the line number is immediately followed by a tab character instead of by a space, the program will not extract the line number correctly. One fix is to insert the following line:

```
695 I = INSTR(L$CHR$(9)):IF I>0
      THEN MID$(L$,I,1) = " "
```

Thanks to Ron Hall, John Knox, and Donald Graft for pointing out some of these conversion problems and bugs.

Jim Monagan
Iowa City, IA

The program CROSSREF is a valuable utility that saves a good deal of time in program writing and debugging. However, the program does not properly handle tabs typed immediately after a line number, whether the line number is typed manually or by means of the AUTO command. My Basic is Basic-80 revision 5.21 running under CP/M version 5.2.02, but I suspect the problem arises in other Basics as well. The problem is that the program "sees" a line number 0 for lines that contain a tab after the line number and which have no spaces in the line. For lines that have a tab after the line number and one or more spaces in the remainder of the line, the program may see the correct line number, but will miss any references occurring prior to the first space. I have modified the program to properly handle tabs. The modification requires a new line 700 and four additional statements.

```
700 LP1 = INSTR(L$," "):
    LP2 = INSTR(L$,CHR$(9))
702 IF LP2 = 0 THEN
      LP = LP1:GOTO 708
704 IF LP1 = 0 THEN
      LP = LP2:GOTO 708
706 IF LP2>LP1 THEN
      LP = LP1 ELSE LP = LP2
708 LN = VAL(LEFT$(L$,LP)):
    PRINT LN,
```

Donald Graft
Naperville, IL

Pascal/MT compiler

The review of the Pascal/MT compiler by Alan Miller (IA Jul 81) was very well done and he should be complimented. I did wish that he had included in each of his reviews some analysis of both sequential and direct files.

Henry Lucas
Westmont, IL

PASS it on

There was an error in the price you quoted for our Professional Authoring Software System ("Learning with Micros" IA May 81). PASS is licensed to end users through an agreement calling for a $5,000 annual licensing fee. In addition there is a $10,000 one time charge during the initial year. Included with this fee is authoring instruction and system maintenance.

Adrian R. Clark
Bell & Howell
Audio Visual Products Division
Chicago, IL

Multi-grievances

Re: "Inventor's Sketchpad" (IA Mar 81), I am at odds with Roger C. Garrett's discussion on multi-tasking and the general view taken by microcomputerists of this important concept. Multi-tasking is presently the most severe limitation stonewalling the microcomputer's acceptance into the small business market.

The prevailing attitude by microcomputerists of "who needs anything more than a single-user system?" is totally unacceptable to the business user. The present concept of the business micro is a single-user, single-task system. In my experience, this would only apply to the smallest of businesses. Any business with more than four employees would derive a far better cost/benefit ratio from a multi-user, multi-tasking system. If you don't have to mind the business, then you could probably afford to enter data into the computer, one job at a time, for the better part of each day. It is likely to take that long. Everyone is so locked into the single-user microcomputer concept, that there are very few who have attempted to expand its possibilities into an area that begs for low priced computer power.

Anthony D. Choate
Louisville, KY

PILOT language

In the illustration accompanying the "Computer Language Roundup" article by Bernard Conrad Cole (IA Jun 81), the PILOT language is prominent along with Fortran, Basic, Forth and Pascal. But some readers may wonder what it is and what it is for, since it is not mentioned at all in the article.

PILOT attempts to be exceptionally easy to learn and use for conversational teaching and testing. It has been used most often for computer-assisted learning exercises, but also as a conversational front end to other systems.

John A. Starkweather
San Francisco, CA

Made to order

Re: "Editor's Notebook" (IA May 81), your preference for typewritten copy in articles submitted for possible publication leaves me somewhat confounded, because I have been contemplating the purchase of a microcomputer with a letter quality printer and a word processing systems as a professional writing tool. Are there professionally established publishers' requirements to which word processing systems should conform? Why, for instance, do you have an objection to right justified copy? Are dot-matrix printers generally acceptable to publishers?

Larry E. Johnson
Minneapolis, MN

We can't speak for other publications, but here's our policy concerning submitted manuscripts: They don't have to be pretty; just unambiguously readable. We can read the product of dot-matrix printers just as well as that of traditional typewriters, so there's no need to penalize them on that score. Some word processors justify the right-hand margin by inserting extra spaces between words, and this can sometimes cause ambiguities in technical material. All word processing systems we have seen are capable of producing acceptable manuscripts—as long as they give both upper- and lower-case output. The reason for double-spacing, of course, is to facilitate copy-editing. ***—TF***

Reportor update

I congratulate you for a fair and even-handed review of the Creator and Reportor programs ("Business Software Review," IA May 81). However, the programs are no longer being marketed by Complete Business Systems. I am, at present, negotiating the marketing rights with several companies. If any reader wants further information concerning these products, please direct him to write to me or to those advertising the product, and not to Complete Business Systems.

Bruce W. Tonkin
34069 Hainesville Rd.
Round Lake, IL 60073

What would Emily say?

Re: "Buying a Computer by RFP" (IA Mar 81), the author, D.E. Cortesi laments the unprofessional attitude of computer suppliers. I noticed he did not include a single "please" or "thank you" in his three sample RFPs. Had he sent me (a consultant) such a brusque "request", I would have round-filed it, SASE or no. Likely several of his "unprofessional" suppliers did so. *But* when they are to use his form to reply, *they* can say "sorry..." Be courteous, right?

Thanks.

L.H.
San Diego, CA

Sufferings are over

I would like to encourage you to review more fully some of the software from Micro Systems Software of Hollywood, FL. I'm a microcomputing software consumer who has suffered through TRSDOS 2.1 and VTOS 3.0 until finding DOSPLUS 3.1. Since finding this DOS, I've just about relegated other DOSes I've used in the past to the archives. DOSPLUS works so smoothly that many of my other utilities are now not necessary. Programs such as cross references, renumbering, search and replace, and a delete-and-insert routine

WHAT'S THE KEY TO BUYING A COMPUTER?

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Before and after the sale we work with you to configure the system that serves you best. We help you get your system up and running smoothly. Assistance is always just a phone call away.

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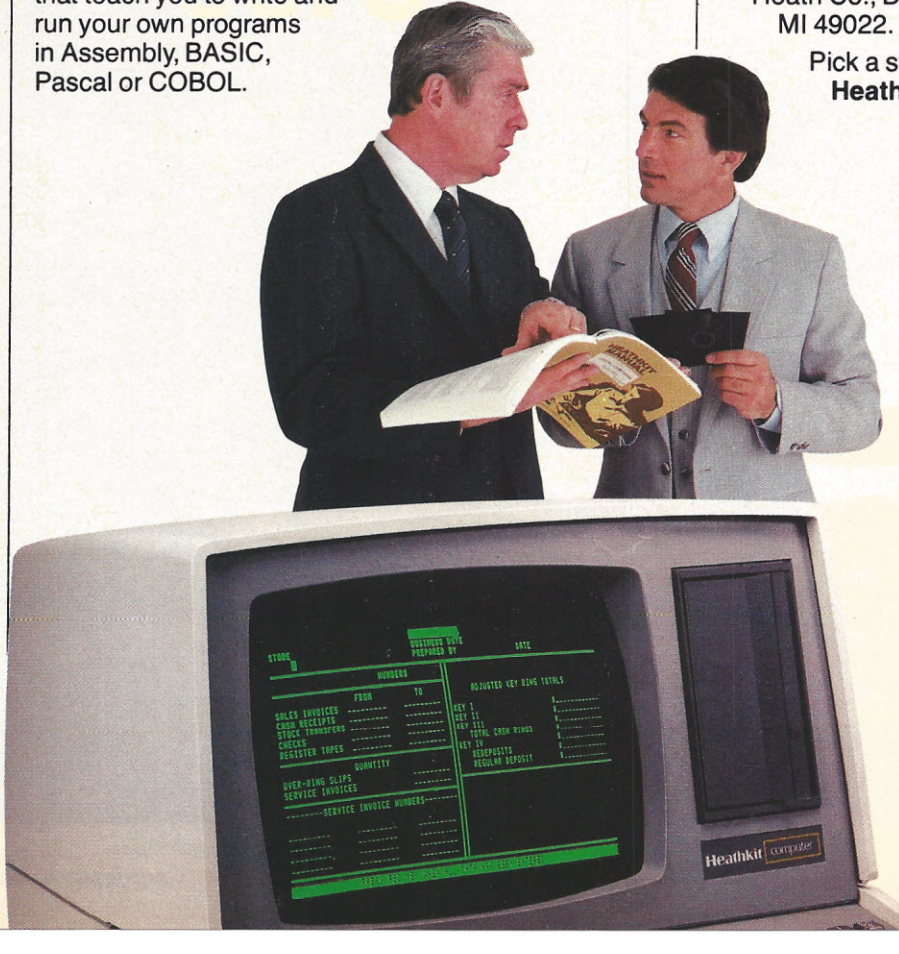

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CP-203A

are all part of the Basic provided on DOSPLUS. This is one company I'll buy from without wondering whether all I'll receive is badly conceived programs elaborately wrapped in barriers to their use.

Fred W. Smith
Randleman, NC

Reader interface

Perhaps some of your readers could help me with a problem. I have been looking for a free standing data base management system that will run under Apple UCSD Pascal 2.1 in a manner similar to Micro Lab's Data Factory or Stoneware's DB Master. I have seen nothing similar advertised and all my inquires have produced negative results. I would appreciate any inputs.

Gerald Perkins
Det. 5, AFSCF(87)
APO San Francisco, CA 96334

I am trying to find someone who is working in the field of voice-to-print technology. I spent several days with Texas Instruments, but they are not prepared to become involved in the area and estimate a time of two or more years before they have a marketable product. Their concern is for 100% accuracy as opposed to basic communication. I have lost all hearing in my right ear and am down to 18% comprehension on the left and think that I had better find an alternate means of verbal input while there is still something left. Any leads will be appreciated.

M.D. Haugen
601 7th Street
Boulder City, NV 89005

Re: "Textwriter" (IA Mar 81), I wonder if the program could be converted to Atari Basic. After a number of trials, I could not get it to work in my Atari 800. I would be most glad for any assistance.

Djoni Sukohardjo
26, Lorong L Telok Kurau
Singapore, 1542

I am in urgent need of information on A.P.T. or Compact programming languages for numerically controlled industrial equipment. A reference to a manufacturer or another information source would be greatly appreciated. I am developing a programming service to small industrial accounts who can't afford in-house programming. I am a process control analyst by profession, but I need information on the above languages to handle machine shop work.

Frank Stanzione
6340 Ellsworth Pl.
Merrillville, IN 46410

I heard about an inexpensive EPROM eraser called the BYTE Destroyer. Does anyone have the name and address of the manufacturer and the cost?

F. Lee
R&D Labs
2626 Union Ave.
San Jose, CA 95124

The first East-European computer club, Homebrew Computer Club Europe, has been formed for producers and users of 6800, 6809, Z-80, 8080, 8085, 6502, F8 micros. Write me for further information.

Dr. Simonyi
19 Trencsenyi St.
Budapest, H-1125
Hungary

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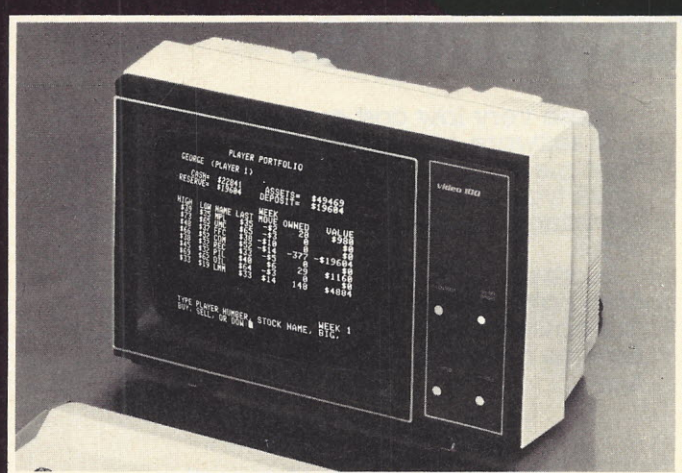
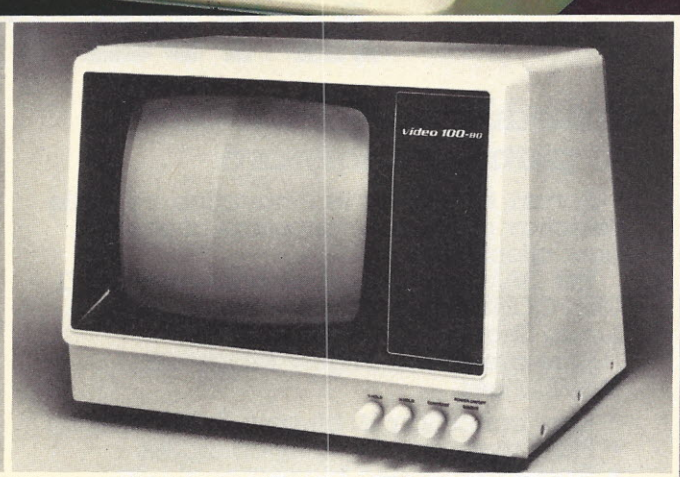
The Amdek 13″ Color Video Monitor is ideal for all personal and business computing applications. Bright jitter-free text allows viewing over extended periods without causing eye fatigue, especially in word processing applications. The low resolution display provides 40 characters wide by 24 characters deep with 260 horizontal lines and 300 vertical lines.

This compact, lightweight monitor (only 25 lbs.) has a molded-in carrying handle, making it easy to move. Its industrial grade construction and shatter resistant case provide reliable service in both office and industrial environments. All front mounted controls make it easily adjustable at a glance without the loss of a single keystroke.





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This highly reliable 12″ black and white monitor features a 12MHz band width and 80 character by 24 line display. Plug-in compatibility with Apple, Atari, Radio Shack, O.S.I., Micro-Term and Exidy make this the perfect text display for almost any system.

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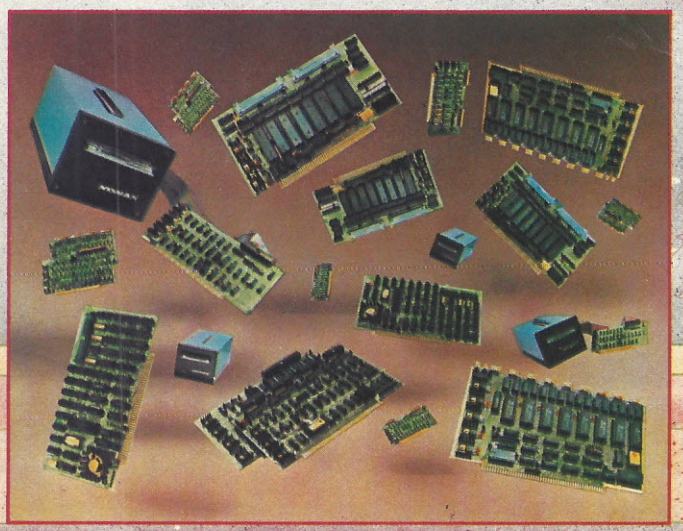

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Konan offers a selection of other fine tape and disk controller products and is actively pursuing license agreements.

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Applications for exhibit space at CeBIT '82 now being accepted

The Hanover Trade Fair Organization announced that it is now accepting applications for exhibit by North American exhibitors planning to participate in the Hanover Fair, April 21-28, 1982 and in particular, the exhibit category, World Center for Office and Data Technology.

In the U.S. contact: Robert Wallace, U.S. Department of Commerce, ITA/OEP /IPD Room 6015a, Washington, D.C. 20230, or Joachim Schafer, Hanover Fairs Information Center, P.O. Box 338, Whitehouse, NJ 08888. In Canada contact: Mrs. Susan Cooke, Hanover Fairs Information Center, 15 Totonto St., Suite 702, Toronto, Ontario M5C 2E3.

Facsimile system transmits letters overseas in seconds

A new facsimile system is being used within the U.S. Postal Service's Intelpost network to transmit letters and other documents overseas in just seconds.

The Superfax system, developed by Rapdcom Inc., Fairfield, NJ, electronically scans and converts any message—typed, handwritten or drawn —into digital signals that can be sent by telephone, microwave or satellite.

The International Electronic Post service began overseas operations to London in January 1981 from post office locations in Washington and New York. Seventeen additional cities in the British Isles are included.

North American service to Toronto started in September 1980 and subsequently was extended. Expansion of the Intelpost digital facsimile network is planned for Argentina, Belgium, France, West Germany, The Netherlands, and Switzerland.

The superspeed facsimile equipment consists of a high resolution scanner coupled with special data compression techniques that allow a standard 11-in. page to be electronically read three to ten times faster than other facsimile equipment.

In addition to high speed, the system was designed for high volume. It can handle an average of 400 8½-in. by 11-in. pages per hour.

Annual shipment of personal computers facing dramatic upswing

Personal computers will continue to be among the fastest growing products in the computer industry, according to a recent study by Venture Development Corp., Wellesley, MA.

From just under 400,000 units in 1980, annual shipments will increase to almost 2 million in 1985 for an effective annual growth of over 37%, says the report.

Priced under $10,000 and designed for a wide range of home and business applications, personal computers have evolved continually from the old hobby kits of the early 1970s. As the report explains, the home/hobbyist segment is substantially smaller now than when VDC first investigated the market four years ago.

The business user segment will be the fastest growing of the four end user segments examined. Shipments to this segment will increase by 52% annually, a growth rate fueled by new product introductions, and by aggressive promotion from manufacturers and dealers alike.

Shipments to the home/hobby category will grow by 26.2% annually, the

lowest rate of any end user segment. The nationwide survey of personal computer users revealed that the home user is changing in many ways. The "electronics tinkerer" of past years has been largely replaced by the upscale professional with some knowledge of computers.

Shipments to the engineering/scientific segment will grow by 30% annually. The personal computers used by this user segment include the most expensive, high end desktop systems.

Shipments to the education segment, the smallest of the four in terms of total units, will grow by 34% annually. Personal computers used in education are typically designed for instructional purposes, although, in smaller facilities, administration applications may also be run.

Computers comply with FCC standards

Apple II and Apple II Plus personal computers have been certified by the Federal Communications Commission as complying with the commission's standards for electromagnetic interference.

The FCC certification for Class B (personal) computing devices also applies to Apple's Disk II and Silentype Printer, plus the language, Integer/Basic and Applesoft firmware cards.

In an effort to avoid earlier problems caused by interference from citizens band radios, the FCC has set limits on random electronic signals generated by computers and other home devices that can interfere with home television and radio reception. The FCC standard is designed to eliminate interference with neighboring TV sets and radios.

To meet the FCC regulations, a nickel acrylic coating has been developed for the Apple computer and a special ground plane was added to the cables connecting the Apple II and the disk driver.

Telephone subscribers participate in electronic directory test

About 1,500 French homes and businesses recently began using the electronic telephone directory in place of regular telephone directories.

The link-up, in the Ile et Vilaine region of western France, marked the beginning of the second major test of what will eventually be a nationwide electronic directory service.

By the early 1990s, all of France's 30 million telephone subscribers will be using the electronic directory in place of the yellow and white pages. Subscribers will each receive free videotex terminals in place of telephone directories.

In the current trial, subscribers have access to all information in the regional yellow and white page directories—a total of more than a quarter of a million entries, including advertising.

The sophistication of the electronic system is indicated by the fact that whereas the printed version of the yellow pages in France contains some 4,500 topics, the electronic version has 9,000. The expansion in the number of topics was undertaken to ease use of the directory by subscribers who might be unsure which topic to search under, for example health or medical.

Logical links have been established in order to create families or groups of related key-words, such as cars, dealers, garages, repair shops and auto parts. The mix is designed to accommodate the random entry factor, since users may initiate their search from any of these entry points.

The system for the current trial is provided by two consortia, the prime contractors for which are CAP-SOGETI and CIT-ALCATEL. Software is being provided by CAP-SOGETI and SESA.

Videotex/Viewdata implementations face unresolved issues

The emerging Viewdata/Videotex market, whereby TV sets serve as home and business information terminals, faces unresolved technical and social issues, even as this new information activity reaches the billion dollar level, according to a new European market report by Frost & Sullivan, Inc.

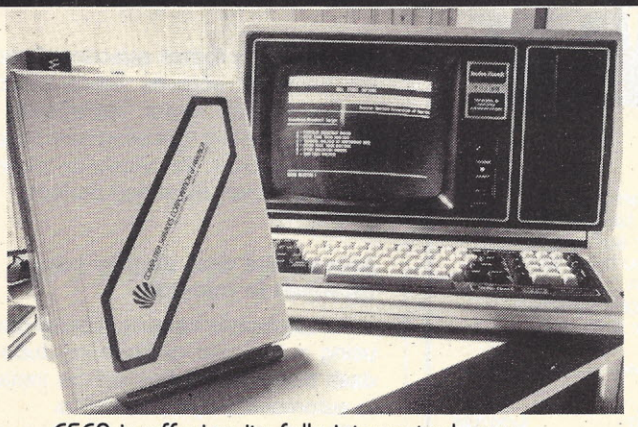
A study forecasts such terminal installations at 20 million units by decade end, with equipment shipments of all kinds reaching $2 billion overall.

According to the study, the vast majority of units will be going into residences at that time, although business applications will dominate the field, probably through 1986. A public and quasi-public "third-market sector"—i.e. schools, airports, hotels, shopping arcades, and the like—will also be coming into play strongly by that time, accounting for 5% of total revenues generated.

Issues that need to be resolved range from program indexing considerations to editorial policy, copyright, and censorship all the way to matters of personal privacy and freedom of expression. For such reasons, market trials have been delayed in Holland and Sweden.

Unresolved technical issues also abound and range from network architec-

SOFTWARE PRICE WAR



CSCA is offering its fully integrated user-oriented business and accounting software package at the, until now, unheard of price of $149. Experts have estimated the development costs for a fully integrated software system ranges between $7,200 and $22,000.† When you buy software the developer has to recapture this expense. Computer Services Corporation of America is selling its software with a view that volume sales can almost negate this development cost.

OUR GUARANTEE — Buy both our software and that of our competitors (who will no doubt charge several times our price because they need to recapture their development cost). Compare the two systems and we know you'll return theirs (make sure they'll let you return their software). If you decide not to keep our system, then return it within 45 days for a full refund. Once you've used our system we're confident you'll be delighted.

†Microcomputers for Business, Applications, 1979

Available for Apple*, TRS-80, and most other systems

*The Apple version requires the Microsoft Z80 softcard.

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CSCA has CBASIC, CP/M and Microsoft Z80 softcard in stock.

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ture to display format selection. Reading off home-TV screens presents some severe human factor limitations. For example, ambient light conditions typically are inadequate for Videotex viewing, especially over extended periods.

Automobile data display panel foreseen in mid-80s

An automobile instrument panel display using a vehicular cathode ray tube for dash board installation will be installed in automobiles by the mid-80s.

The device has been developed by scientists at Zenith Radio Corp., Glenview, IL. The V-CRT display uses a cathode ray tube with specially formulated phospors in conjunction with a unique electron gun. The result is a compact, flexible instrument display that presents data and graphics in a sharp, clear format that is readable in indirect or direct sunlight.

Designed for the maximum flexibility required for interface with microprocessor-controlled automotive electrical systems, the V-CRT, when used with the proper filters, permits display of such operating data as speed, fuel, coolant levels, temperature, and oil pressure, as well as time, turn signals, headlights, etc. in six colors.

On push-button command, the V-CRT monitor can also display such data as miles-to-empty; estimated time of arrival; maps, travel information; and diagnostic and service information.

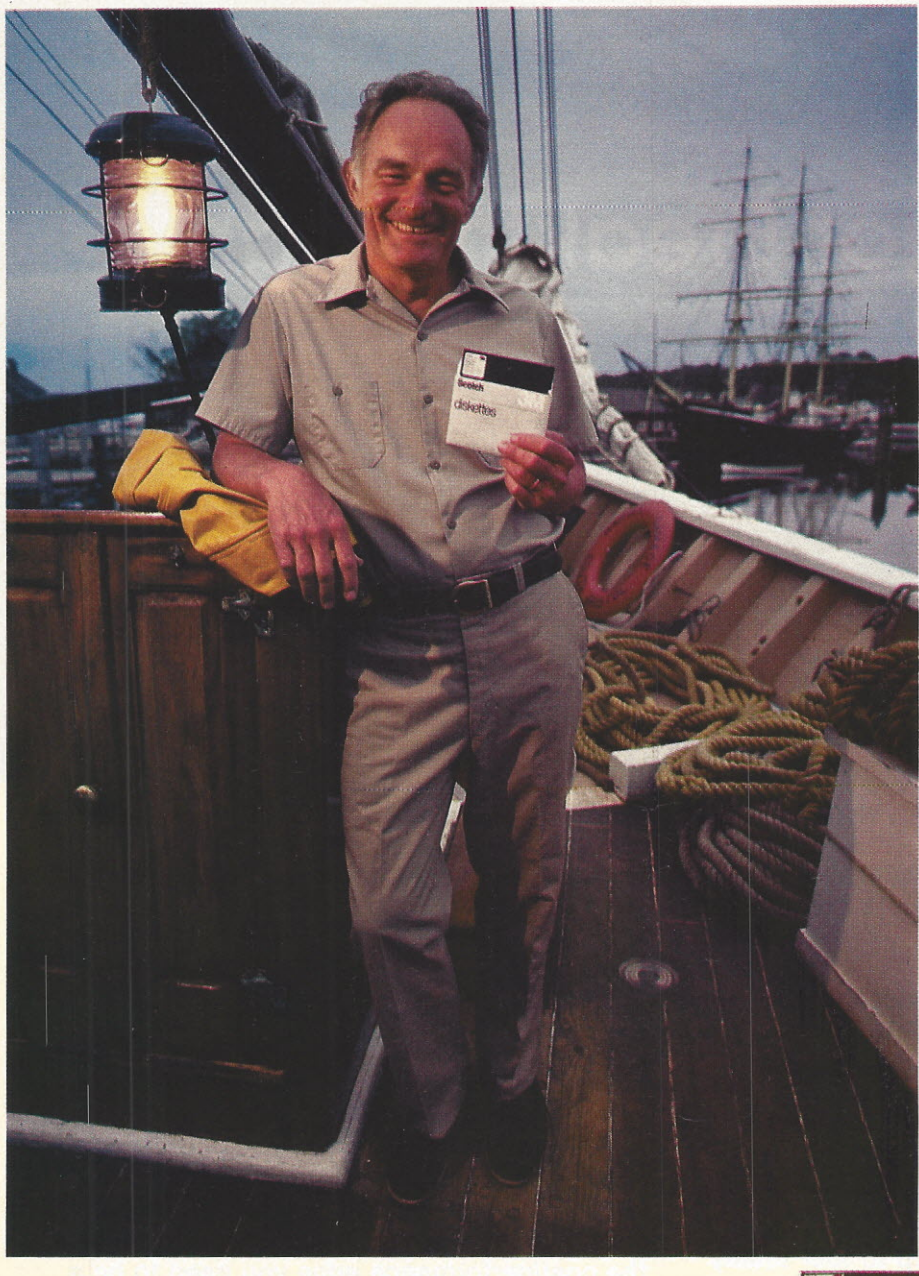
DBMS market projected to $4.1 billion by 1989

The market for data base management systems (DBMS) will increase 600% between 1980 and 1989, according to a recent report by Strategic Business Services, Inc., San Jose, CA.

The report forecasts the rapid rise and slow growth of the data base back-end processor. According to the report, shipments of back-end processors will slow down between 1985 and 1989.

The technology section of the report traces the evolution of DBMSs from hierarchical to relational, showing the need for specialized hardware such as associative planar memories and intelligent disks to maximize the potential benefits of a relational architecture. The study concludes that the DBMS in the current large mainframe environment is an artificial add-on attached to obsolescent operating systems. Furthermore, as new operating systems evolve, the data base function will become an integral part of the operating system.

"This year, I'm taking 2,000 people sailing. I wouldn't trust the travel arrangements to anything less than Scotch® Brand Diskettes."



Eben Whitcomb, Owner-Operator, Dirigo Cruise Company, Clinton, CT

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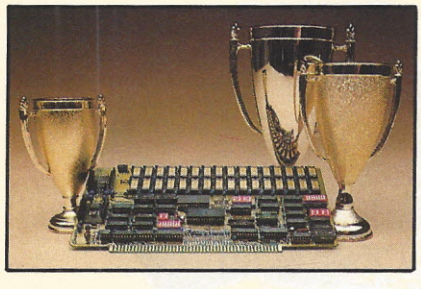

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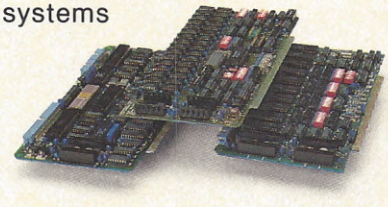

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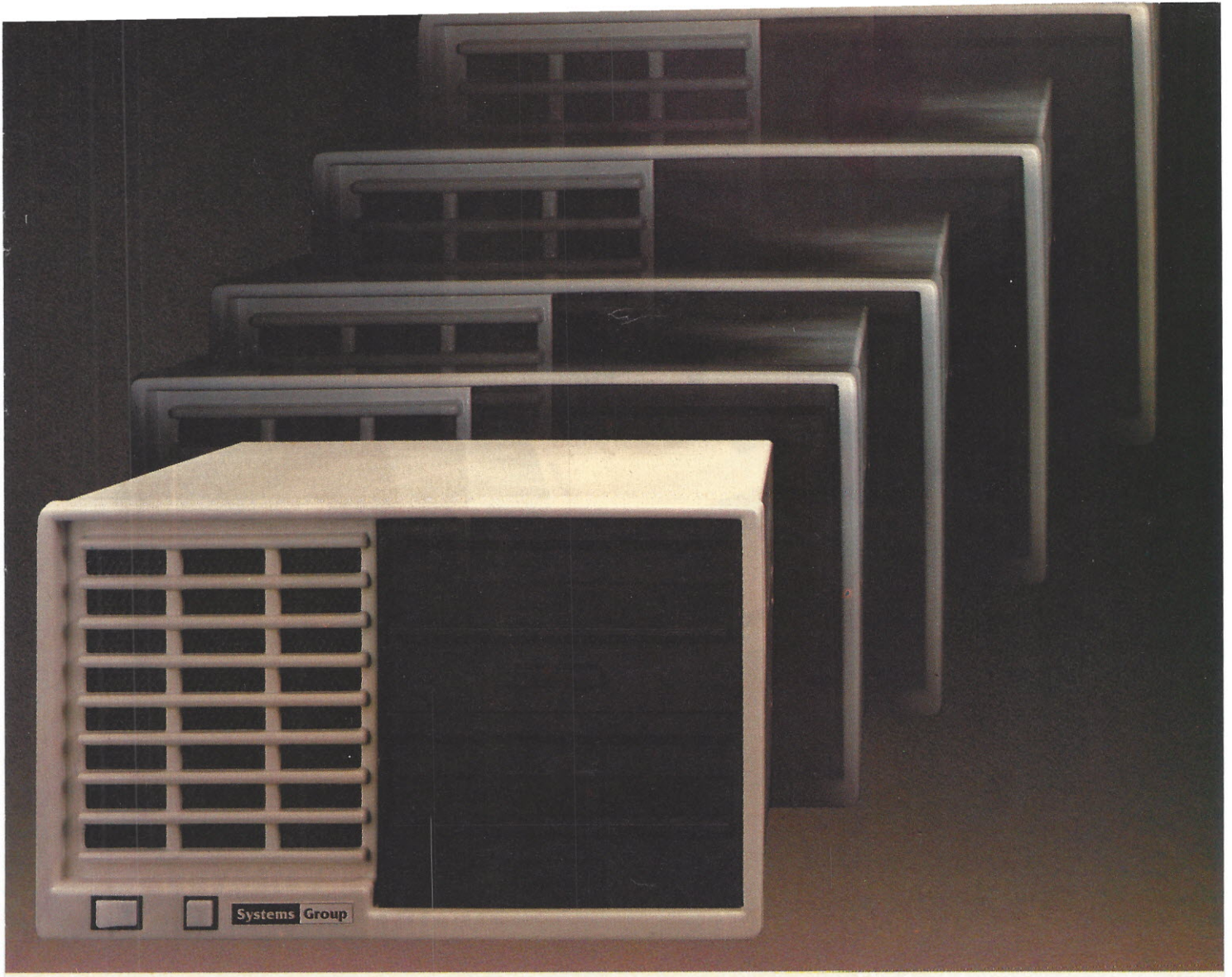

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Jurisprudent Computerist

By Elliott MacLennan
Attorney at Law

USC Law Seminar

In last month's issue, a special edition of this column focused on the discussions that took place during the first day of the Computer Law Institute, sponsored by the University of Southern California. The seminar was conducted in May at the Bonaventure Hotel, Los Angeles, CA. The first day's topics included proprietary rights in data processing products. Following is a review of the concluding day's topics, covering issues relating to contracting for data processing products.

Introduction to Current Issues in Data Processing Contracts

Robert Bigelow (Bigelow and Saltzberg, MA) is the senior computer lawyer in the U.S. His presentation discussed trends in the computer industry as they relate to legal issues, how to detect problem areas and practical suggestions for avoiding unnecessary litigation.

In a historical overview, Bigelow noted that in addition to the traditional manufacturer/developer v. user disputes, many intra-family disputes have erupted between various member components of the computer industry. Examples include manufacturer v. manufacturer; manufacturer v. distributor; and cross suits involving the above groups v. OEMs and retail outlets.

Who owns the software? With the proliferation of software licensing, sales and unauthorized copying, determining who really owns title to the software becomes a problem. A smart lawyer will insert a warranty of title to the software in any legal document he prepares. Such a warranty offers scant protection when the real owner appears and the false owner disappears; a user has a legal crowbar placed across his right to use a critical program. The problem is not going to diminish until a central registry of software titles exists—similar to that of recording a security arrangement with respect to goods (tangible personal property) covered by the Uniform Commercial Code in effect in 49 states.

Structuring and Negotiating Software Development Contracts

Miles Gilburne (Blanc, Gilburne, Peters, Williams and Johnston, Los Angeles, CA) is a legal specialist in the areas of contracts, trade secrets, tax, antitrust and other matters relating to data processing systems.

Gilburne's approach to his subject was to set forth several compelling arguments for management of a user company planning to go on line with a computer system. This would enable a tightly integrated negotiating team composed of various disciplines in order to prevent the vendor from making an end run around management by persuading the DP people that this is the system they should acquire.

Software contracts are considerably more negotiable than hardware contracts. He reasoned, therefore, that the user should not be bashful about making significant demands upon a software house.

In combining law, budget and expected performance, Gilburne described the negotiated elements of a contract in terms of how a computer lawyer should inform management. For example, the implications of the risks in the software procurement allocate these general risks into specific watertight categories.

He strongly argued that the user should include in the Request For Proposal (RFP) definitive functional specifications so the vendor can accurately price the merchandise. Vendors may incur cost overruns observed from the user's standpoint where the user did not provide the vendor with anything more than vague concepts and expectations. Such vagueness prevents the vendor from adhering to a fixed price or closed contract. The vendor can legitimately request a time and materials or open-end contract. Users often expend substantially larger sums than originally estimated because of a poorly planned RFP.

When the user is unable to provide clear functional specifications, he should engage the vendor on a time-and-materials courtship basis, holding the vendor to live acceptance tests and close professional supervision by in-house or outside DP personnel. Supervision can encompass the situation wherein the user provides progress reports bi-monthly stating the progress vendor has made toward resolving the problem.

Estoppel is the legal way of saying that someone is stopped or prevented from doing something he wants to do or say. In the software development contract area, rolling estoppel is Gilburne's term for legally denying a vendor from claiming a problem exists (even if user-generated) where the vendor fails to submit the bargained-for progress reports on a timely basis.

The remainder of his presentation constituted a forthright and clear explanation of providing for penalties and incentives to make the vendor perform and encourage the user to describe the areas in which he will cooperate with the vendor.

Selected Problems in Major System Procurement

Duncan Davidson (Irell and Manella, Los Angeles, CA) specializes in matters related to computers ranging from negotiating computer procurement agreements to advising venture capitalists. Davidson's superbly organized presentation and outline materials focused upon negotiation tactics, business results and legal issues.

The following six contract provisions are items that he felt were essential to obtaining a workable system:

1) Make them specific enough for the user to have a contractual basis to sue the vendor upon performance failure.
2) Develop a major task timetable with practical remedies. Examples include speedy arbitration procedures, credits, offsets against payment and other legal devices short of contract termination and expensive litigation.
3) Condition payments or the major portion of payments for the procured system on acceptance tests satisfactory to the user.
4) Lock vendor into rapid response and repair time.
5) Balance out up time commitment with response and repair time.
6) Try to obtain replacement commitment for a given failure rate over a stated period of time. A user can expect a vendor to abruptly refuse to negotiate this clause. The user should bargain away this clause for a stronger position on another clause that he believes is more realistic to survive the negotiations.

Davidson further pointed out that leases do not come within the scope of the Uniform Commercial Code of the various

states. Judges, however, like to analogize UCC law to computer lease arrangements. Also, users can fight back against a strong warrantly limitation and disclaimer clause by attaching to the contract all vendor advertising brochures, specifications, system announcements and the like. This will create enough legal ambiguity to permit a second guessing of the contract by a court with the expectation that the court will throw out or water down the warranty limitation and disclaimer provisions.

It is easy to see from Davidson's presentation that considerable litigation can be avoided with this systematic approach to negotiating computer procurements.

Contracts for the Mass Markets

Paul Bent is Vice President and General Counsel of Century Financial Services, an equipment leasing firm. He serves also as a Director of the Computer Law Association. He offered the most thought provoking subject mater presentation of the two day institute.

Beginning his presentation, he defined mass market to be the marketplace for computer products that differ in four essential respects from the commercial DP markets. These include:

1) Volume. The volume of consumer products dwarfs commercial applications and the price per unit for consumer purchases is considerably less than its commercial counterparts.
2) Breadth. The consumer market ranges from presumptions of user sophistication and technical expertise to complete naivete.
3) Plebeianism. Little in the way of business or commercial sophistication on the part of the user/buyer is presumed.
4) Information. Virtually no negotiated elements exist in computer product sales by way of the mass market: vendor and user never meet.

The key word, he noted, for the legal issues surrounding the mass market is "consumer." Computer lawyers must familiarize themselves with consumer legislation including statutory and regulatory issues not normally dealt with in the commercial DP market. Computer lawyers, he advised, must likewise learn new avenues for redress of injuries and for airing of grievances besides those traditionally used by commerical DP users.

Zeroing in on specific consumer legislation, he discussed the Magnuson-Moss Act and the Federal Trade Commission (FTC) rules in which the latter imposes extensive requirements upon sellers of goods through mail orders. He noted that the FTC rules declare it to be "an unfair method of competition, and an unfair or deceptive act or practice" for a seller to solicit mail order sales. An exception would occur if, at the time of solicitation, the seller reasonably expects to be able to ship the merchandise "within the time clearly and conspicuously stated" in the solicitation. If there is no such statement, it should be shipped within 30 days after receipt of a proper order.

The true highlight of his presentation was his submission to his audience of two warranty and warranty limitation and disclaimer clauses used by an American computer manufacturer. The ease by which he set out the previously hidden (but now starkly revealed) flaws in the consumer warranty provisions was impressive. Even more important was the impact of how the consumer was misled, clearly shown while piercing the empty protection the computer company probably believed it possessed by its warranty clauses.

Effective Use of the Limitation of Liability Clause in Contracts

Stephen Hollman (Lakin and Spears, Palo Alto, CA) is a business, commercial and securities lawyer. He described

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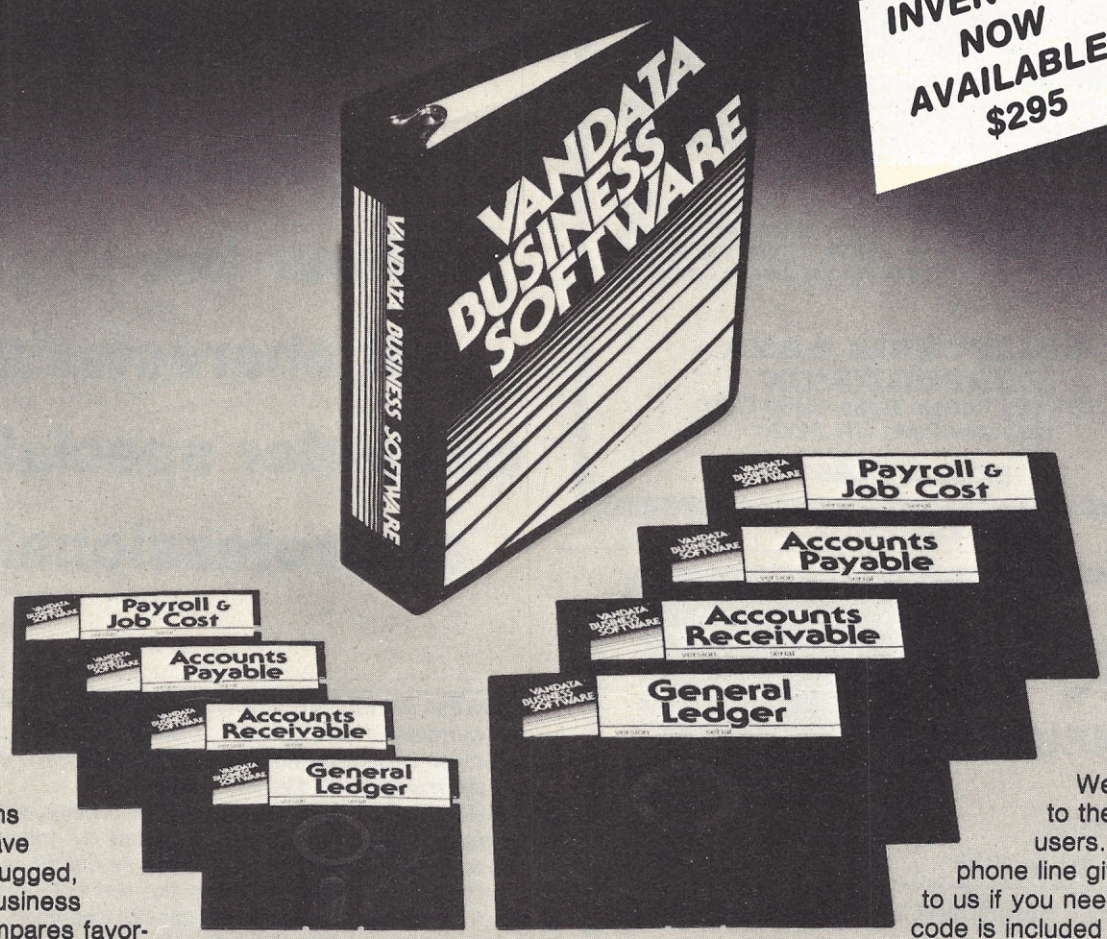

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warranties, limitations and disclaimers from an evenly balanced user-friendly, vendor-friendly point of view. Then he revealed a batch of new cases he had discovered that provide users with an entirely new legal weapon to circumvent the standard liability disclaimers ever-present in vendor contracts where the user is a business person acquiring a turnkey system. The new weapon is tort law, specifically products liability and negligence.

A tort is a civil wrong in the same way robbery is a criminal wrong. For a criminal wrong you go to jail. For a tort, a vendor pays money to an injured user. Torts are social engineering; one does not need a contract for a tort to occur.

Accordingly, before Hollman's announcement, money damages were not available for a businessman whose business was injured because of a defect in vendor's product. Defective product protection has long been available to consumers. The effect of the injection of tort law into business computer acquisition is that user can make an end run around the warrantly limitation and disclaimer clauses by claiming a tort. Such clauses may be watertight from the law of contracts but are a sieve from the law of torts.

The present state of our law does not characterize computer specialists as professionals.

Relief for vendors from products liability and negligent misrepresentation claims is permitted by tort disclaimers virtually non-existent in standard vendor contracts. However, an attempt by a vendor to plug the tort hole and thus limit vendor's liability will only be successful where the vendor and user specifically bargained for the products acquired and where they are in equal economic bargaining positions. "This," Hollman pointed out, "is usually not the case in turnkey purchases."

The focus of Hollman's presentation was to demonstrate how both vendor and user could convert dollars needlessly spent in expensive litigation into a war chest for "fighting it out in the marketplace". He succeeded.

Professional Malpractice Liability

Daniel Brooks is an attorney working in the area of computer application issues for the Division of Market Regulation, Securities and Exchange Commission, Washington, D.C.

Brooks provided a microscopic analysis of where the issue of malpractice stands with respect to computer professionals.

The present state of our law does not characterize computer specialists as professionals. One principal reason is that our courts have been in disagreement over just exactly what is a "professional." The effect of professional status is to require the professional to be held to a higher standard of care with respect to his clients than does a layman or even a skilled craftsman. Failing to meet the professional standard of

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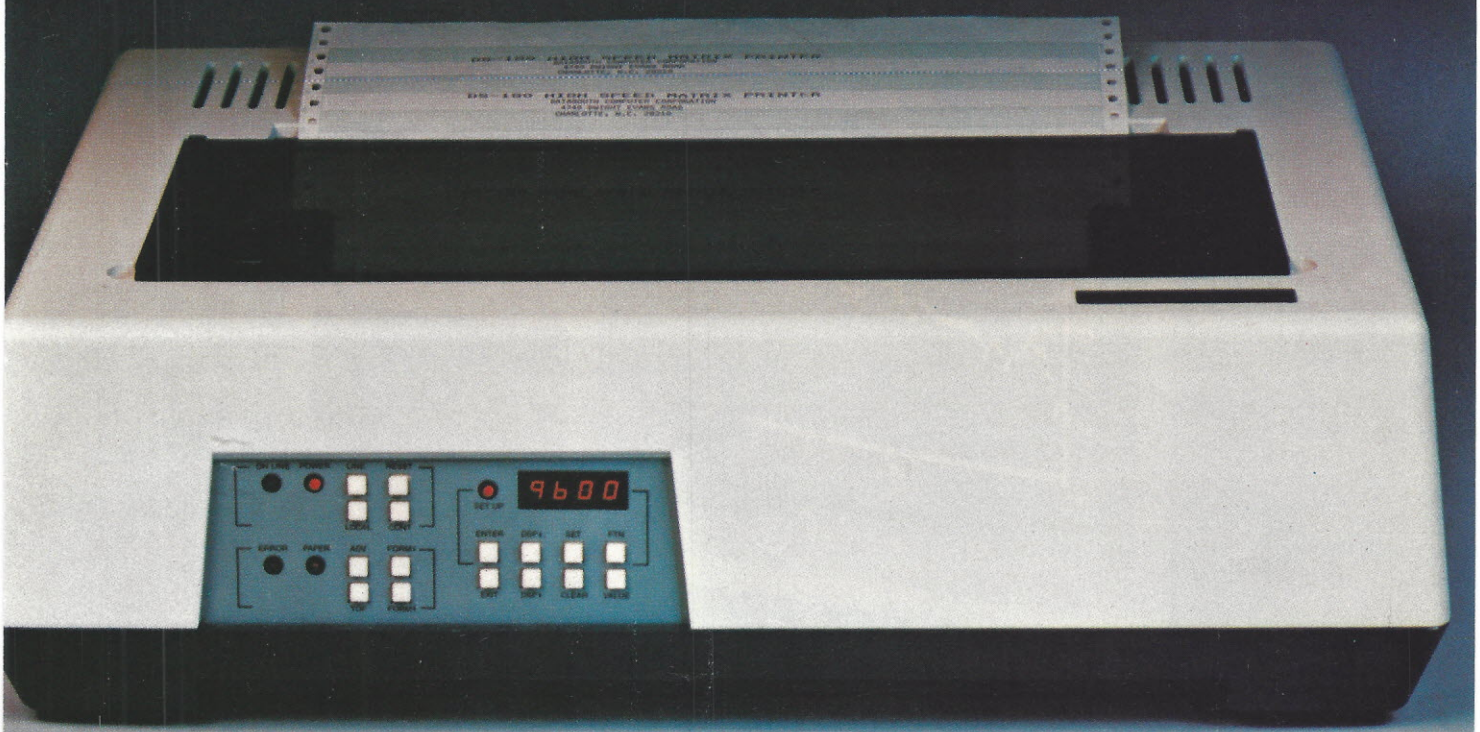

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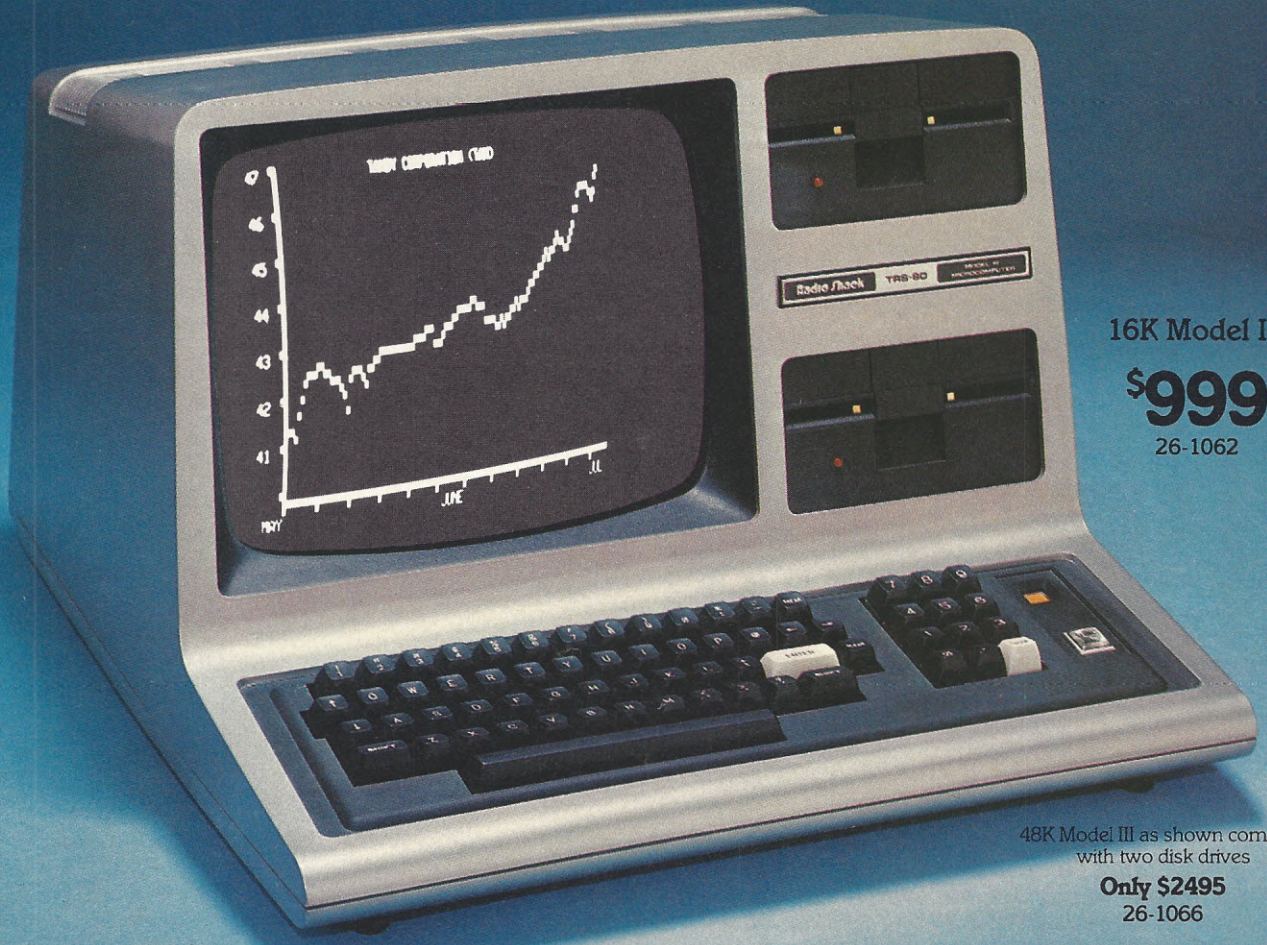

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care results in money being awarded to the injured client by a court of law or arbitration panel.

To be sure, an increasingly aware user market is making more claims against computer specialists for their alleged negligence. To date, only a few cases have addressed the issue of malpractice for the computer professional.

On a sliding scale, Brooks felt that the more pedigreed the specialist, the more likely the imposition of malpractice. The desire for certified recognition of computer specialists promulgated by the various computer societies will not pass unnoticed by the courts.

The key to the malpractice question, noted Brooks, is the increasing number of claims that appear to be winding their way through the court system. It is expected that a body of law will soon be developed to provide guidance in presently uncharted waters.

The Vendor's and Vendee's Views on Negotiating Data Processing Contracts

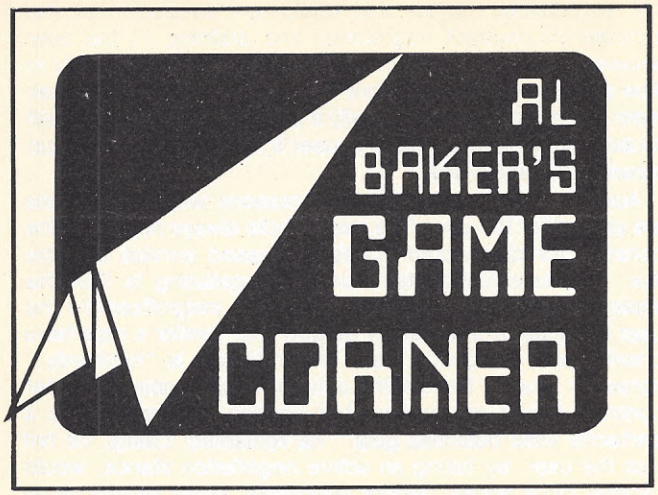
Joseph Auer, co-author of "Computer Contract Negotiations," the only non-lawyer speaker, teamed up with Richard Porter, Burrough's Legal Director for government contracts in a well coordinated approach to the mechanics of negotiations.

Auer analyzed the phenomenon of why sophisticated business executives sign standard form vendor contracts. He gave several reasons why the business does negotiate: 1) the user is up against the vendor's sophisticated marketing and negotiating team; 2) the user is overwhelmed by his own lack of sophistication in advanced computer technology, while, simultaneously impressed by the vendor's product array; 3) the user is too busy to plan for and negotiate a computer installation; 4) the user's staff has no "clear financial incentive" to negotiate a more cost favorable contract; 5) the vendor enjoys an information advantage by having the technical staff to answer and overcome any of the user's questions or objections; 6) tradition in computer contracting has emphasized vendor and equipment evaluation of the expense of contract negotiation and drafting; 7) the user believes that lengthy negotiations with vendors are costly in time and money and therefore counter-productive. The user feels that negotiation, especially if attorneys are involved, will cause undue delays and the user's attorney may end up blowing the whole deal.

Auer set forth some excellent reasons why negotiations are critical for the user. The user should always negotiate the contract for discounted prices, increased service and the like. The sole justification for not negotiating is that the implementation of a computer system is insignificant to the user because of the friendly rapport that vendor's reps have created with the user's staff. This rationale is "foolhardy," noted Mr. Auer. "Developing a mutually agreeable computer contract based on documented vendor 'deliverables' is a perfectly valid business goal," he remarked. Lastly, he felt that the user, by taking an active negotiation stance, would receive more honest vendor appraisals, fewer vendor ploys and more realistic initial price concessions. There is a frightful reality to Auer's remarks on users who fail to negotiate, as we have observed in past experience.

The sum and substance of Porter's remarks was an admonition to users and their attorneys not to waste time and energy in attempting to negotiate what is not negotiable from a manufacturer's standpoint. The principal point he discussed was the legal clauses in a manufacturer's contract—for instance, the consequential damages (loss and profits) clause.

Although I opposed his statement on vendor clause fixation, I agreed with his closing remark. I don't believe that any lawyer, no matter how proficient, can walk off the street into negotiations for a reasonably complex computer contract and function effectively. In order to do a credible job, some familiarity with the client's requirements and operations and some familiarity with the industry and its particular language and practices is essential. □



The Sound Game

This month's Atari program was submitted by Brian Oliva of Lynn, MA. It uses a feature not present on any of the other popular personal computers: multiple sounds. The object of the game is to match the sound generated by the computer within a time limit. And it is a lot more difficult than you might think.

The original program uses paddles, but because more of you own joysticks, it has been converted. After pressing the START button, the program will generate two sounds: the one you must match and another you control with the joystick. Move the joystick left and right. Your tone will move up and down the scale. Once you think you've matched the computer's note, press the joystick button. If you take too long (about 10 seconds), the computer will also assume you are done. In either case, it will tell you how well (or poorly) you did and give you nine more chances to improve your skill.

Referring to listing 1, line 40 clears the screen and the player is asked to push the START button on line 50. Until the button is pushed (PEEK(53279) = 6), line 60 freezes the program. Once started, the computer gives the player ten random tones to match. This ten note loop is controlled by lines 70 and 120. Inside the loop, line 90 determines the pitch of the note. It can vary between 1 and 255. Line 92 starts sounding the note with a clear tone (10) and moderate volume (8) using sound register 0.

The program determines the starting note for the player in a similar manner on line 95. The only difference is that the note must not be within 40 pitch units of the computer's note. If the notes begin too close together, the player's task could become too easy.

Once the two notes are chosen, the loop between lines 98 and 104 lets the player try to match them. If he moves the joystick left, STRIG(0) will equal 11 and G will increase by one. This will decrease the pitch of the note on line 102. But if the joystick is pushed right, the reverse will happen and line 102 will increase the pitch of the note. Pitch numbers below 1 or over 255 don't work, so lines 100 and 101 prevent this from happening. If the player holds the joystick to either the left or right too long, the maximum (1), or minimum pitch (255) will continuously sound.

As long as the player doesn't push the joystick button, STRIG(0) will equal 1 and the IF statement on line 104 will be true. The loop will continue until finished, at which time the PRINT statement will ring the keyboard's bell (CHR$(253)). But if the player does press the joystick button, the IF statement will fail and the loop will be bypassed. In both cases, line 106 will eventually turn off the sounds and the program will tell the player how well he did. Lines 110 and 112 print out the pitch numbers of the two notes, and line 116 adds the amount by which the player missed to his total error count.

The subroutine beginning on line 200 is used at the end of each of the ten tries. It prints out a message based on how well the player did. If he did poorly (S>4), it also plays the keyboard's bell five times in the hopes of waking him up! Lines 240 through 270 can be used to create a timed delay that can be ended by the player. I use these lines in many programs to speed up the action. Line 240 waits until the joystick button has been released, in case the player had pressed it to end his guess. Once released, lines 260 and 270 loop for about three seconds—long enough for the player to read the message. But if he doesn't want to read it, or reads it quickly, he can press the button to end the loop and return to the program.

Lines 132 to 175 end the program after the player's ten guesses. Based on his performance, the player is more or less encouraged or told off. If you don't like the messages or think of others you would rather use, then change them.

More on Mining the Asteroids

Mining the Asteroids first appeared in IA Jul 80 for the TRS-80 model I. In December, it was converted to the TRS-80 Color Computer, and in March, I challenged readers to convert it to Applesoft. Cliff Harris of Anaheim, CA has taken up the challenge, and the result is in listing 5. He has successfully converted the program to use the paddles, sound and low resolution graphics of the Apple.

The program is similar to the Color Computer version and should be easy to understand with the following possible exceptions. Lines 160 and 170 convert the 255 different values of the Apple paddles into −1, 0 and 1. Sound is generated on lines 185 and 195 using the speaker toggle location at −16336. These lines create different sounds based on the speed of the space ship. Since four lines on the screen are reserved for text, Cliff extended the labels for the spaceship's vital statistics. Line 785 prints the labels and sets the scroll line on the screen to line 21. This stops any other print statements from removing them. The remainder of the program uses common Applesoft features and should be easy to follow.

Responses to the Reading Level Program

I have received several letters about the Reading Level program published in May, one of them from the author of this month's game. Brian has converted the program to the Atari. Listing 3 is the original Applesoft program and listing 4 includes his changes.

I received a very good letter from Mr. R. W. W. Taylor of the National Technical Institute for the Deaf. He pointed out, quite correctly, that the use of word size is a poor criteria for the number of syllables in a word. In his words, "A still simple, but more accurate, approach to counting the syllables in a word is: let each vowel (including y) determine a new syllable unless it is preceded by another vowel. Also, do not count a vowel other than y that appears at the end of a word. (This scheme will err primarily for short words, which does not concern us at present.)" To add his more accurate logic to the program, replace lines 135 to 170 of listing 3 with the lines shown in listing 2.□

Listing 1

```
10 REM THE SOUND GAME
 20 REM
30 REM
40 GRAPHICS 0
45 T=0:G=0:R=0:S=0
 50 PRINT "Press START button to besi
   n"
60 IF PEEK(53279)<>6 THEN 60
```

```
62 REM
64 REM GAME LOOP
66 REM
 70 FOR X=1 TO 10
 75 GRAPHICS 0
 80 PRINT :PRINT "Tone #";X
 85 REM PICK A NOTE
 90 R=INT(RND(0)*255+1)
 92 SOUND 0,R,10,8
 94 PRINT :PRINT "Move JOYSTICK left
    or right until   tones match"
 95 G=INT(RND(0)*255+1):IF ABS(G-R)<4
    0 THEN 95
 96 REM CLOCK ABOUT 10 SECONDS, OR PU
    SH OF BUTTON
 98 FOR Q=1 TO 500
 99 G=G+(STICK(0)=11)-(STICK(0)=7)
 100 IF G<0 THEN G=0
 101 IF G>255 THEN G=255
 102 SOUND 1,G,10,8
 104 IF STRIG(0) THEN NEXT Q:PRINT CH
    R$(253);"Time's up"
 105 REM STOP SOUND - SHOW RESULT
 106 SOUND 0,0,0,0:SOUND 1,0,0,0
 110 PRINT :PRINT "Computer tone ="R
 112 PRINT :PRINT "Your choice   ="G
 114 REM CALCULATE SCORE
 116 T=T+ABS(G-R)
 118 GOSUB 200
 120 NEXT X
 130 REM END GAME - PRINT RESULTS
 132 PRINT :PRINT "Total deviation fr
    om actual"
 134 PRINT "for 10 tries was ";T
 136 IF T=0 THEN PRINT "A PERFECT sco
    re - Amazing!"
 138 IF T>0 AND T<6 THEN PRINT "EXCEL
    LENT!"
 140 IF T>5 AND T<10 THEN PRINT "That
    's a great score!"
 142 IF T>9 AND T<16 THEN PRINT "That
    's a good score"
 144 IF T>15 AND T<25 THEN PRINT "Goo
    d"
 146 IF T>24 AND T<61 THEN PRINT "You
    can do better - Try again"
 148 IF T>60 AND T<116 THEN PRINT "Th
    at's not so good"
 150 IF T>115 THEN PRINT "Better get
    your hearing checked!"
 175 END
 180 REM
 185 REM PRINT INTERMEDIATE SCORE
 190 REM
 200 S=ABS(G-R)
 202 IF S=0 THEN PRINT "PERFECT"
 204 IF S=1 THEN PRINT "EXCELLENT"
 206 IF S=2 THEN PRINT "Good"
 208 IF S=3 THEN PRINT "Try harder"
 210 IF S=4 THEN PRINT "Pay closer at
    tention!"
 212 IF S>4 THEN PRINT "WAKE UP":FOR
    I=1 TO 5:PRINT CHR$(253):NEXT I
 240 IF STRIG(0) THEN 240
 260 FOR K=1 TO 1000:IF STRIG(0)=0 TH
    EN K=1000
 270 NEXT K:RETURN
```

Listing 2

```
]LIST 106
106 S = 0:WC = 0:VC = 0:V = 0:PV = 0:Y = 0:B = 0:RL = 0

]LIST 135-170
135  REM  RETURN CHARACTERS SEPARATE SENTENCES AND END WORDS
136  IF  ASC (S$) <  > 13 THEN 140
137 S = S + 1
138  GOTO 142
140  REM   BLANKS SEPARATE WORDS
141  IF S$ <  > " " THEN 150
142  REM   MULTIPLE BLANKS ARE DISREGARDED, HOWEVER
143  IF B = 1 THEN 170
144 B = 1:WC = WC + 1
145  REM  DISALLOW ANY FINAL VOWEL EXCEPT Y
146 VC = VC - V + Y
147  IF VC > 3 THEN HS = HS + 1
148 VC = 0:PV = 0
149  GOTO 170
150  REM  OTHERWISE CHECK FOR VOWEL
151 B = 0
152 Y = 0
153  IF S$ = "Y" THEN Y = 1
154 V = Y
155  IF S$ = "A" THEN V = 1
156  IF S$ = "E" THEN V = 1
157  IF S$ = "I" THEN V = 1
158  IF S$ = "O" THEN V = 1
159  IF S$ = "U" THEN V = 1
160  REM  ONLY COUNT IF PRECEDING CHARACTER WAS NOT A VOWEL
161  IF PV = 0 THEN VC = VC + V
162 PV = V
170  NEXT A
```

Listing 3

```
PR#0
]LIST

5  REM


READING LEVEL PROGRAM



6  REM


KEEP TEXT IN MEMORY STARTI
     NG
  AT LOCATION 17000


30 X = 17000
31  REM

 TEXT INPUT LOOP:
   HANDL
     E TEXT, ->, AND <-

40  GET K$
45  REM

IF ->, THEN USE MEMORY

50  IF  ASC (K$) = 21 THEN 94
65  REM
```

```
IF <-, THEN BACKUP

70  IF  ASC (K$) <  > 8 THEN 80
71  IF X = 17000 THEN 40
72 X = X - 1
74  PRINT K$;
76  GOTO 40
77  REM

PUT TEXT IN MEMORY

80  POKE X, ASC (K$)
85  REM

IF CTRL-C, THEN END-OF-TE
    XT

90  IF  ASC (K$) = 3 THEN 105
91  REM

PRINT TEXT

94  PRINT  CHR$ ( PEEK (X));
95 X = X + 1
96  GOTO 40
97  REM

COMPUTE GRADE LEVEL STAT
    ISTICS


105  HOME
110  FOR A = 17000 TO X
120 S$ =  CHR$ ( PEEK (A))
121  REM

PRINT TEXT

130  PRINT S$;
135  REM

BLANKS SEPARATE WORDS

140  IF S$ <  > " " THEN 151
142  IF WL > 8 THEN HS = HS + 1
144  IF WL > 0 THEN WC = WC + 1
146 WL = 0
148  GOTO 170
149  REM

RETURN KEY ENDS SENTANCE
    S
  AND WORDS

151  IF  ASC (S$) <  > 13 THEN 16
    0
152 WL = WL - 1
154 S = S + 1
156  GOTO 142
157  REM

EVERYTHING ELSE IS PART
    OF
  A WORD

160 WL = WL + 1
170  NEXT A
171  REM



DISPLAY STATISTICS AND L
    EVEL


180  REM   READING LEVEL IS .4 *
    (WC/S + HS*( 100/WC) )
185  IF S = 0 THEN S = 1
186  IF WC = 0 THEN WC = 1
190 RL = .4 * (WC / S + HS * 100 /
    WC)
200  PRINT : PRINT : PRINT
210  PRINT WC;" WORDS"
220  PRINT S;" SENTENCES"
230  PRINT HS;" WORDS WITH THREE
    OR MORE SYLLABLES"
240  PRINT  CHR$ (7)
245 RL =  INT (RL * 10 + .5) / 10

250  PRINT "THE READING LEVEL IS
    ABOUT GRADE ";RL
260  END
```

Listing 4

```
15  OPEN #1,4,0,"K:"
20  DIM K$(1),S$(1)
30  X=13000
40  GET #1,K
45  K$=CHR$(K)
50 IF ASC(K$)=31 THEN 94
70 IF ASC(K$)<>30 THEN 80
71 IF X=13000 THEN 40
105 GRAPHICS 0
110 FOR A = 13000 TO X
151 IF ASC(S$)<>155 THEN 160
240 PRINT CHR$(253)
```

Listings continue on page 144

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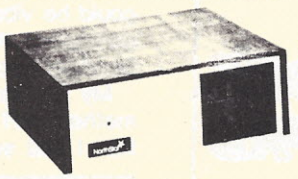

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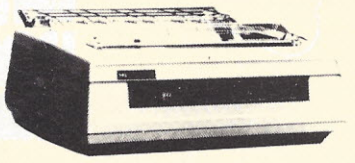

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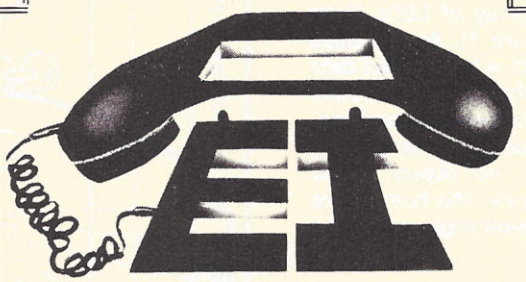

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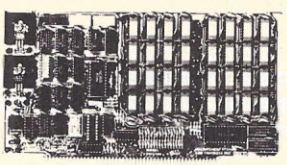

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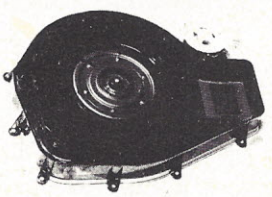

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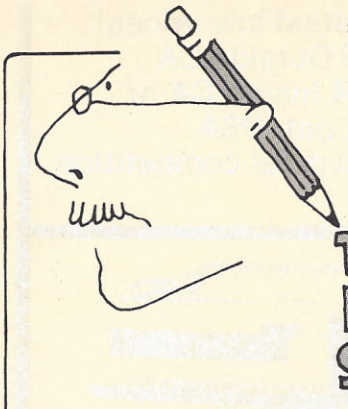


THE INVENTOR'S SKETCHPAD

by Roger C. Garrett

Three-Dimensional Displays

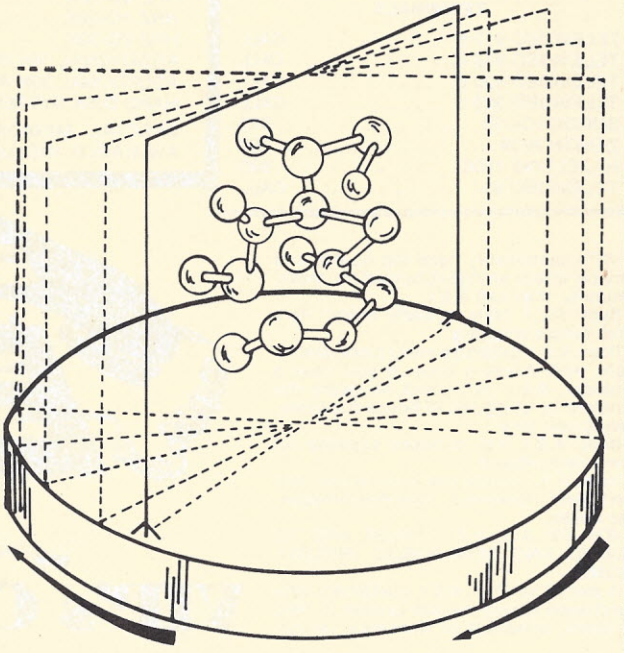
An interesting article I read recently described a new development by the Massachusetts Institute of Technology's Innovation Center. The Center, under the supervision of Dr. David Jansson, has developed a device capable of displaying computer-generated objects in true, space-occupying 3-D.

What they did was mount a square array of LEDs (light emitting diodes) on a rotating table (figure 1). As the table spins at about 30 revolutions per second, a high speed data channel selectively turns on and off the individual LEDs. Essentially, at each rotational position (there being, perhaps, several hundred such positions in each complete revolution) the LED array depicts one 'slice' of the object to be displayed. Since it spins at a very high rate, the human eye integrates the separate slices into a seemingly complete continuous 3-D image.

The image can be generated from entirely artificial data to produce, for example, an image of what some hypothetical molecule might look like. From real data it can produce, perhaps, a 3-D view of a CAT (computerized axial tomograph) used in medical diagnosis. In fact, the Center's next project is aimed at linking up its display device to a CAT system, thus providing the medical profession with one more sophisticated computer-based tool.

In IA Oct 78, this column described how an array of LEDs could be vibrated back and forth to produce a 3-D image. I concluded that such a vibration approach was not very feasible, since it would probably tear itself to pieces.

My alternate suggestion was a rotating translucent spiral method. MIT took an approach somewhat between the two that I had suggested and simply rotated the LED array. I



The viewing screen seems to disappear as the viewing table is rotated at high speeds, leaving the computer-generated image "floating" in space.

Figure 1. MIT's 3D display

suspect, however, that it must require a fairly complex setup to maintain the necessary electronic connections between the computer supplying the data and the LED array, since the array is spinning on a platform and the computer is presumably stationary. It appeared to me that there must be a simpler way to display the images, so I set out to design an alternate method. In fact, I came up with two.

In the first approach, the array of LEDs is replaced with a fiber-optic plate in which each display point (corresponding to a single LED) is actually one end of an optical fiber (figure 2). The array of fibers is brought down into a square bundle just above a stationary CRT below the display plate. The image displayed on this CRT is transmitted via the fiber bundle up to the display plate.

Notice that the deflection coils for the CRT are attached to the rotating table. This keeps the image displayed on the CRT in the correct orientation relative to the spinning fiber optic bundle. As with MIT's spinning LED array, a high-speed data

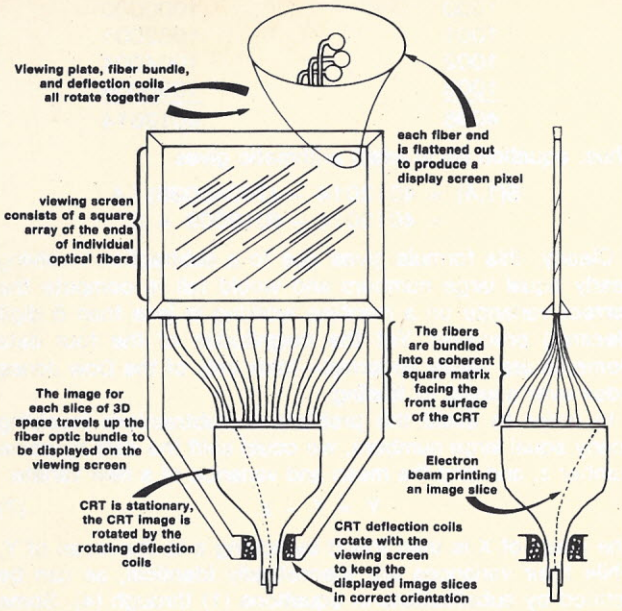


Figure 2. A fiber optic approach

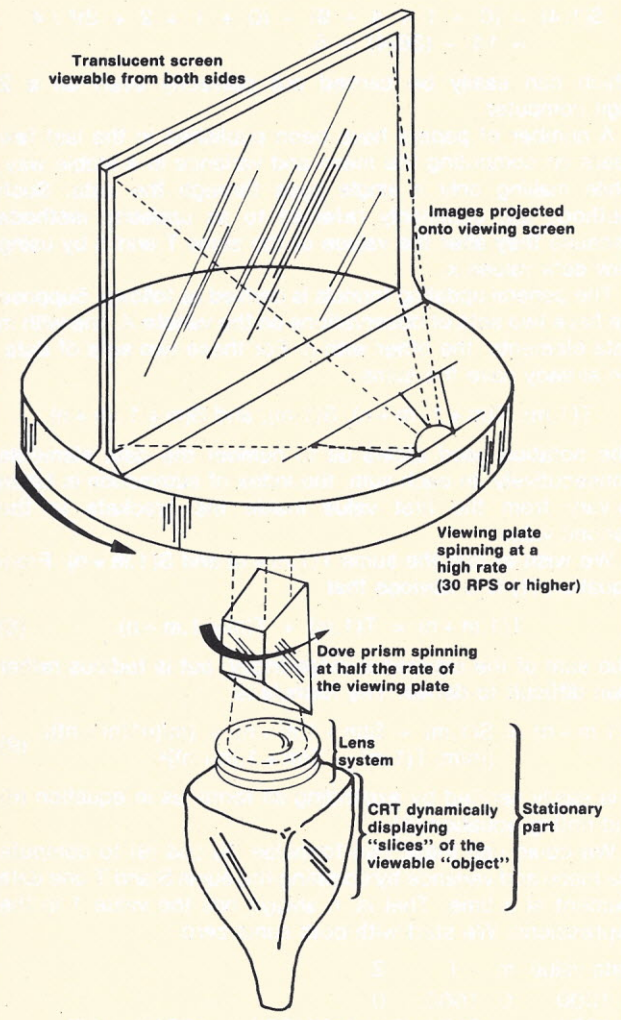


Figure 3. Perspective/exploded view of the functional components of the 3D viewing system

channel keeps the correct image slices displayed on the CRT, creating the full 3-D image.

The advantage of this setup is that only a relatively few electrical connections need be made with the spinning table, namely those to drive the deflection coils, as opposed to the huge number of connections needed to drive an array of LEDs. It might even be possible to make the deflection coil driving the connection by inductive coils so that no actual physical connections need be made at all.

An even more simple method is possible, using an optical device known as a dove prism. Such a prism has the interesting capability of rotating images. If an image is projected through the long axis of a dove prism and the prism is rotated around that axis, the image is rotated twice for every single rotation of the prism. Such prisms are used in the television industry to rotate images. Since it is somewhat inconvenient to turn an entire television camera upside down to get an upside down

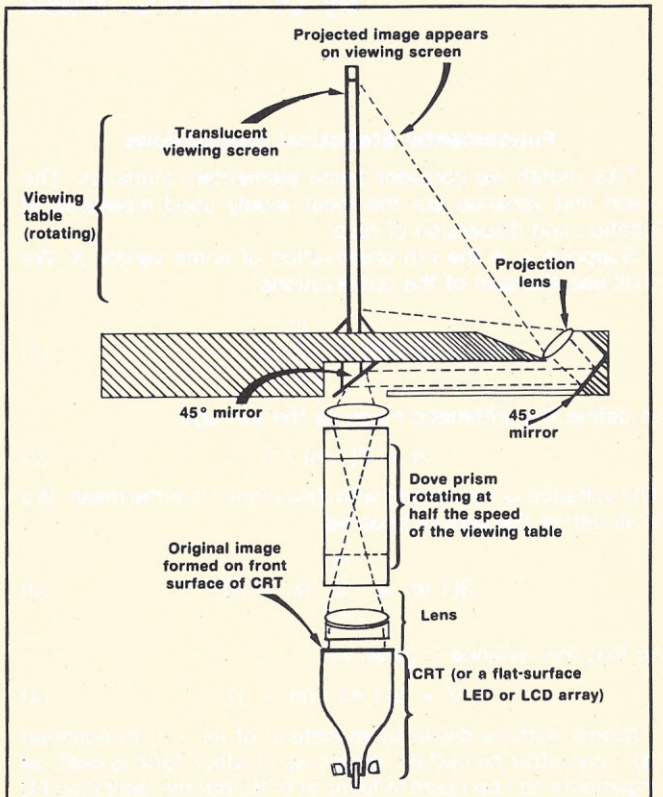
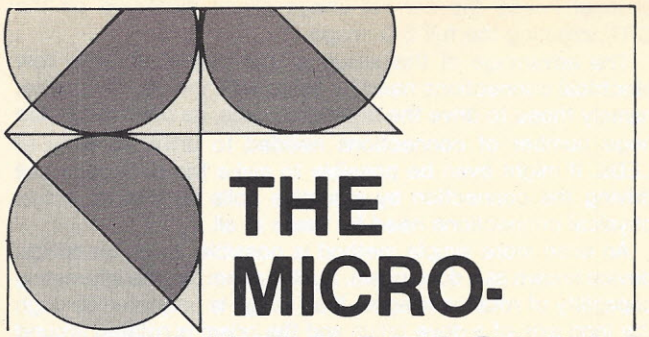


Figure 4. Another view of the functional components

shot, a dove prism is placed in front of the lens. When the prism is rotated the resultant image also rotates.

So, instead of LEDs or fiber optics comprising the image plate of our 3-D system, let's use a simple translucent viewing screen (figures 3 and 4). In the base of the rotating table, we place a set of mirrors and lenses to transmit an image, projected into the bottom of the table onto the viewing screen. Between the CRT and the rotating table, we place our dove prism and, via a suitable gear network, rotate it at exactly one half the rate of the rotating table. Now we don't have to rotate the CRT—or even the deflection coils. The entire CRT remains stationary and the image produced on the front of the CRT likewise remains stationary. It is the dove prism that rotates the image, so that it is always properly oriented towards the viewing screen.

Such a system should be profoundly more useful than MIT's LED array since it requires less complicated electronics, is less expensive, has higher display resolution, and can even display images in color. And such a display device could be connected to its own reverse implementation (3-D image capture system) to provide real-time real-life images of microscopic specimens. □



THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Fundamental Statistical Calculations

This month we consider some elementary statistics. The mean and variance are the most widely used measures of location and dispersion of data.

Suppose x_i is the i'th observation of some variate X. We shall use the sum of the observations

$$T(1,m) = \sum_{i=1}^{m} x_i \qquad (1)$$

to define the arithmetic mean as the average

$$A = T(1,m) / m. \qquad (2)$$

The variance is concerned with deviations from the mean. We shall define the sum of squares

$$S(1,m) = \sum_{i=1}^{m} (x_i - A)^2, \qquad (3)$$

so that the variance is given as

$$V = S(1,m) / (m - 1). \qquad (4)$$

(Some authors divide by m instead of (m − 1) in equation (4). I can offer no certain opinion as to which form is best, as arguments can be made in favor of both, but the definition (4) seems to be most common in practice.)

Calculation of the mean and variance via the sums (1) and (3) is straightforward. However, we must pass through the data twice—once to compute the mean and once to compute the variance. This may be costly when large amounts of data are involved, so that we are forced to read the data from tape or disk. Therefore, we seek to compute both the mean and the variance in a single pass through the data.

Expansion of the sum (3) gives

$$\begin{aligned} S(1,m) &= \left(\sum_{i=1}^{m} x_i^2\right) - 2A \sum_{i=1}^{m} x_i + A^2 \sum_{i=1}^{m} (1) \\ &= \sum_{i=1}^{m} x_i^2 - 2m A^2 + m A^2 = \sum_{i=1}^{m} x_i^2 - m A^2. \end{aligned} \qquad (5)$$

This "textbook" formula for the variance (sum of squares) may also be written

$$S(1,m) = \sum_{i=1}^{m} x_i^2 - (T(1,m))^2 / m. \qquad (6)$$

Unfortunately it is a very poor formula by which to compute the variance, even though we form the sums of x_i and x_i^2 simultaneously.

Consider, for instance, the following data.

x	x^2
1000	1000000
1001	1002001
1002	1004004
1003	1006009
4006	4012014

Thus, equation (6) in exact arithmetic gives

$$\begin{aligned} S(1,4) &= 4012014 - (16048036) / 4 \\ &= 4012014 - 4012009 = 5. \end{aligned}$$

Clearly, this formula gives rise to a subtraction involving nearly equal large numbers and would fail to compute the correct variance on a machine working in less than 8 digit (decimal) precision. Yet the magnitudes of the four data elements are hardly abnormal—think only of the Dow Jones index over a week of trading.

In order to avoid the problem of subtractions involving nearly equal large numbers, we could *shift* the data by some number z, and find the mean and variance of a new variate

$$Y = X - z. \qquad (7)$$

The mean of X is then found by adding z to the mean of Y, while their variances are theoretically identical, as can be verified by substitutions in equations (1) through (4). Some practitioners take the first data value for z; others enter a "guess" of the mean of the variate X. The first strategy is poor when x_1 is not representative of the rest of the data. The second strategy cannot be automated. Nevertheless, in the example above, choosing z = 1000 gives

$$\begin{aligned} S(1,4) &= (0 + 1 + 4 + 9) - (0 + 1 + 2 + 3)^2 / 4 \\ &= 14 - (36/4) = 5, \end{aligned}$$

which can easily be carried out correctly even on a 2 digit computer.

A number of papers have been published in the last few years on computing the mean and variance in a stable way, while making only a single pass through the data. Such methods are commonly referred to as *updating* methods because they alter the values of the sums T and S by using new data values x_i.

The general updating formula is derived as follows. Suppose we have two sets of observations on the variate X, one with m data elements, the other with n. For these two sets of data, we already have the sums

$$T(1,m),\ T(m+1,\ m+n),\ S(1,m),\ \text{and}\ S(m+1,\ m+n).$$

The notation used allows us to number the data elements consecutively. In each sum, the index of summation is taken to vary from the first value inside the brackets to the second value.

We wish to find the sums T(1,m+n) and S(1,m+n). From equation (1) it is obvious that

$$T(1,m+n) = T(1,m) + T(m+1,m+n). \qquad (8)$$

The sum of the squares is more tricky, but is tedious rather than difficult to derive. The formula is

$$\begin{aligned} S(1,m+n) = S(1,m) &+ S(m+1,m+n) + (m/(n*(m+n))) \\ &[(n/m)\,T(1,m) - T(m+1,m+n)]^2 \end{aligned} \qquad (9)$$

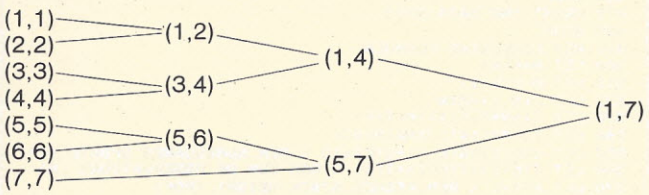
It is easily verified by expanding all terms as in equation (6) and noting equation (8).

We could use these two formulae (8) and (9) to compute the mean and variance by updating the sums S and T one data element at a time. That is, n always has the value 1 in the expressions. We start with both sums zero.

Data value	m	T	S
1000	0	1000	0
1001	1	2001	$0 + (1/2)[1000 - 1001]^2 = 1/2$
1002	2	3003	$1/2 + (2/3)[2001/2 - 1002]^2$ $= 1/2 + 3/2 = 2$
1003	3	4006	$2 + (3/4)[3003/3 - 1003]^2$ $= 2 + 3 = 5$

Clearly, we have found the correct sums and not read the data but once, though there is considerably more effort at each step of the update. This is probably worthwhile in cases involving many thousands of data elements. Of course, when there are many observations, equation (8) should not be used one element at a time, since this will mean adding a small number to a potentially large one. For instance, if we have a million observations of a variate in the range 1 to 10, those added into the sum T late in the calculation are likely to have only their most significant digits counted in the sum. This is the old "small number added to big number" problem. However, there is a delightfully elegant method of finding the mean and variance in a stable way which avoids this difficulty by using equations (8) and (9) on balanced sub-sets of the data. This is the Pairwise Algorithm due to T.F. Chan, G.H. Golub and R.J. LeVeque which is described, along with many other interesting ideas on this subject, in a Stanford University Computer Science report (STAN-CS-79-773).

The Pairwise Algorithm is true to its name. We take all pairs of data elements and form T and S appropriately. Then we combine pairs into fours, fours into eights, and so on. Odd observations do not give rise to difficulties in the general updating formulae (8) and (9). Illustrated below is the structure of the calculation for 7 observations. We use the notation (i,j) to denote the sums S and T for observations i through j.



In preparing a program to implement these ideas, it is important to observe that we do not have to have all the sums of two observations before proceeding to compute those for four observations. In fact, for the calculation involving 7 observations, we can form the sums in the following order

(1,2), (3,4), (1,4), (5,6), (5,7), (1,7).

The calculations can therefore be arranged to use a stack structure which stores S, T and the number of observations, P, for each node in the illustration. Observations are pushed onto the T stack, with the number 1 (or a weighting) onto the P stack and zero onto the sum of squares S. That is, the sum T of a single observation is just the number itself, there is only one such number, and it has a zero sum of squares. Thereafter, the observation can be treated like any other node in the figure.

Manipulating the stacks

If the two top items on the P stack are equal (that is, an equal number of observations), we use the updating formulae (8) and (9) to pop the stacks by combining the sums. Remember that the number of observations on the P stack must also be added together to form the new top element on this stack. This stack pop is repeated if the top two items on the P stack are again equal. Otherwise, a new observation is pushed onto the stack. When the data is exhausted, the updating formulae are used to collapse the stacks to a single level which gives the sums S, T and the number of observations. Note that this means that the amount of data does not have to be known when we begin the calculation—in fact, the data could be coming in over a communications line from a remote instrument.

Listing 1 shows the stack structure at each step in computing mean and variance for the seven data elements 1000, 1001, 1002, ..., 1006.

Listing 2 gives a Basic program implementing the Pairwise Algorithm. This has a different organization from the Fortran program given by Chan, Golub and LeVeque, which is hopefully better suited to Basic programming and debugging.

The program requires a subroutine at line 0660 to return the I'th observation on the variate in variable X. This subroutine may be called with I = 0 to provide initialization of the problem. The subroutine should change I to −1 when the data has been exhausted. An example subroutine is included in the listing which generates observations as scaled integers from Q to R. It can be fairly easily shown that the sum of squares is

$$S(Q,R) = F^2 (R - Q) (R - Q + 1) (R - Q + 2) /12,$$

where F is a user-supplied scaling factor. Moreover, the product (R − Q)(R − Q + 1)(R − Q + 2) is always exactly divisible by 6. This gives a test for variance programs, which is easily generated yet avoids the need for extended precision arithmetic to calculate the "exact" results to which answers are to be compared. While there are statistical and possibly numerical objections to tests based on the integers, this test should still be of value in detecting programming errors. □

Listing 1

```
PVAR - PAIRWISE ALGORITHM
COMPUTES MEAN AND VARIANCE OF DATA
IN A SINGLE PASS BY UPDATING FORMULAE
USE INTEGERS FROM ?1000
   TO  ?1006
SCALING FACTOR (0 USES 1.0/MEAN) ?1

OBSERVATION # 1 =  1000
STACKS  T            S            P
      1000           0            1

OBSERVATION # 2 =  1001
STACKS  T            S            P
      1001           0            1
      1000           0            1

PAIRED SUMS - POP STACK
STACKS  T            S            P
      2001           .5           2

OBSERVATION # 3 =  1002
STACKS  T            S            P
      1002           0            1
      2001           .5           2

OBSERVATION # 4 =  1003
STACKS  T            S            P
      1003           0            1
      1002           0            1
      2001           .5           2

PAIRED SUMS - POP STACK
STACKS  T            S            P
      2005           .5           2
      2001           .5           2

PAIRED SUMS - POP STACK
STACKS  T            S            P
      4006           5            4

OBSERVATION # 5 =  1004
STACKS  T            S            P
      1004           0            1
      4006           5            4
```

```
OBSERVATION # 6 =  1005
STACKS  T              S              P
      1005             0              1
      1004             0              1
      4006             5              4

PAIRED SUMS - POP STACK
STACKS  T              S              P
      2009             .5             2
      4006             5              4

OBSERVATION # 7 =  1006
STACKS  T              S              P
      1006             0              1
      2009             .5             2
      4006             5              4

END OF DATA - COLLAPSE STACK
STACKS  T              S              P
      3015             2              3
      4006             5              4

STACKS  T              S              P
      7021             28             7

RESULTS
 7 POINTS  SUM OF DATA= 7021
MEAN= 1003  SUMSQUARES= 28
VARIANCE= 4.6666667
STOP IN LINE 470
```

Listing 2

```
10 PRINT "PVAR - PAIRWISE ALGORITHM "
20 PRINT "COMPUTES MEAN AND VARIANCE OF DATA"
30 PRINT "IN A SINGLE PASS BY UPDATING FORMULAE"
40 REM AUTHOR J C NASH 810501
50 DIM T(30),S(30),P(30)
60 REM DESIGNED TO SHOW THE ACCUMULATION
70 REM S STORES SUMSQUARES
80 REM P STORES THE NUMBER OF POINTS
90 REM T STORES THE SUM (MEAN  *  # POINTS)
100 REM INITIALIZE DATA
110 LET I=0
120 GOSUB 660 \ REM CALL SUBROUTINE WITH I=0 FOR INIT'L
130 REM STACK POINTER IS K (TOP)
140 LET K=0 \ REM INITIALLY ZERO
150 REM BEGIN READING OBSERVATIONS AND PUSHING ON STACK
160 LET I=I+1 \ REM NEXT DATA ELEMENT
170 GOSUB 660 \ REM GET IT
180 IF I<0 THEN 350 \ REM END DATA?
190 LET K=K+1 \ REM INCREMENT TOP OF STACK
200 IF K<=30 THEN 230
210 PRINT "STACK OVERFLOW"
220 STOP
230 LET P(K)=1 \ REM 1 OBSERVATION AT A TIME
240 LET S(K)=0 \ REM IT HAS ZERO VARIANCE
250 LET T(K)=X \ REM AND IS ITS OWN MEAN
260 PRINT "OBSERVATION #",I," = ",X
270 GOSUB 590
280 IF K=1 THEN 160 \ REM STACK ONLY 1 DEEP
290 REM COLLAPSE STACK?
300 IF P(K)<>P(K-1) THEN 160 \ REM ARE SAMPLES SAME SIZE
310 GOSUB 490 \ REM COMBINES K,K-1
320 PRINT "PAIRED SUMS - POP STACK"
330 GOSUB 590
340 GOTO 280
350 REM END OF DATA -- COMBINE REGARDLESS
360 PRINT "END OF DATA - COLLAPSE STACK"
370 IF K<1 THEN 470
380 IF K=1 THEN 420
390 GOSUB 490
400 GOSUB 590
410 IF K>1 THEN 390
420 PRINT "RESULTS"
430 PRINT P(1)," POINTS  SUM OF DATA=",T(1)
440 PRINT "MEAN=",T(1)/P(1),"  SUMSQUARES=",S(1)
450 IF P(1)>1 THEN PRINT "VARIANCE=",S(1)/(P(1)-1)
460 STOP
470 PRINT "NO DATA ???"
480 STOP
490 REM COMBINING FORMULA
500 LET N=P(K)
510 LET M=P(K-1)
520 LET P(K-1)=M+N
530 LET T1=N*T(K-1)/M-T(K)
540 LET T2=M*T1*T1/(N*(M+N))
550 LET S(K-1)=S(K-1)+S(K)+T2 \ REM SUMSQUARES UPDATE (9)
560 LET T(K-1)=T(K-1)+T(K) \ REM SUM OF OBSERVATIONS (8)
570 LET K=K-1 \ REM REDUCE STACK HEIGHT (POP)
580 RETURN
590 PRINT "STACKS  T              S              P"
600 FOR J=K TO 1 STEP -1
610 PRINT TAB(5),T(J),TAB(20),S(J),TAB(33),P(J)
620 NEXT J
630 PRINT
640 REM INPUT Z$ \ REM HIT (CR) TO CONTINUE
650 RETURN
660 REM NASH TEST USING INTEGERS Q TO R
670 IF I>0 THEN 780
680 PRINT "USE INTEGERS FROM ",
690 INPUT Q
700 PRINT "   TO  ",
710 INPUT R
720 IF R<Q THEN 680 \ REM ERROR CHECK
730 PRINT "SCALING FACTOR (0 USES 1.0/MEAN) ",
740 INPUT F
750 PRINT
760 IF F=0 THEN LET F=2/(Q+R)
770 RETURN \ REM END INITIALIZATION
780 REM CHECK FOR END OF DATA
790 IF I<=R-Q+1 THEN 820
800 LET I=-1 \ REM END OF DATA
810 RETURN
820 LET X=I+Q-1 \ REM SIMPLE SHIFT TO GET OBSERVATION
830 LET X=X*F \ REM THEN SCALE
840 RETURN
850 END
```

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CIRCLE INQUIRY NO. 34

Learning with Micros

by Louis E. Frenzel

Industrial Training Applications

When you think of computers and education, you probably think of microcomputer applications in colleges, high schools and elementary schools. However, because micros are excellent dispensers of self-paced learning materials, they can be used in virtually any educational or training situation.

Business, industry and government are now discovering this. Business and industry are rapidly adopting microcomputers for word processing, forecasting and decision making, budgeting, accounting, inventory and other data processing functions. Meanwhile, many managers and executives are beginning to see that the micro can also be an excellent training tool.

Most companies use some form of training to teach new employees or to train existing employees. In an effort to improve productivity and efficiency in the work place, industrial trainers are developing and presenting courses teaching subjects applicable to the company's work.

Such programs have proven remarkably effective in minimizing employee mistakes, improving quality, changing attitudes, reducing absences and generally increasing overall employee performance. Whether it's a course to teach new hires how to operate a fork lift truck, solder a printed circuit board or deal with telephone complaints from customers, industrial training has demonstrated its ability to change people's behavior. The result is often improved company performance and greater customer satisfaction.

Training in business and industry also affects management. There is a variety of courses given to improve managerial effectiveness and to teach managers new skills. Training in sales techniques is a particularly big field, as sales training invariably produces impressive sales increases.

No movement in progress

This whole business/industry training movement is generally known as human resources development (HRD). The whole HRD movement is a huge and growing market. Accurate data on market size are hard to come by, but one estimate puts the figure at nearly ten billion dollars per year. This is money spent by industry and government directly on all forms of training, including seminars and workshops, in-house courses, video tapes, films, A/V machines, books and all manner of learning paraphernalia. Industrial trainers are just now recognizing that the microcomputer is part of all this.

Recently I attended the annual conference of the American Society for Training and Development (ASTD) in Boston. ASTD is *the* professional society of HRD practitioners and industrial trainers. They meet each year to discuss experiences, share new methods and techniques and learn how to perform their jobs better. I was pleasantly surprised to see several talks and meetings on CAI and the use of computers in industrial training. There were even several hardware and software firms displaying applicable wares at the exhibits. We can expect to see a lot of microcomputer and CAI action in the industrial training field in the future.

Because of the computer's unique ability to sequentially present information to be learned, provide feedback and test automatically, it is an ideal tool for industrial training. Although micros do not fit well in all learning applications, they are highly effective for many subjects. Subjects that adapt themselves to programmed instruction or, in some cases, to A/V methods are prospective candidates for CAI.

Individualized training is possible

The micro facilitates self-paced learning. In many training situations, it is undesirable to keep an employee from his job too long. Conducting long residence classes is expensive and the employee is non-productive during the training period. So trainers try to teach as much as possible in the least amount of time. Also the training situation is not always convenient with the employee's work schedule. Self-paced training programs can often solve this problem. When a micro is used, the employee can sit down when he or she has time and go through the learning process.

Perhaps the biggest problem is the lack of software. What else is new? There is never enough good software, although some really significant advances have been made in the past year. While a tremendous amount of software is now being developed for the school market, little or nothing is being done for industrial training. This is not surprising in view of the very broad range of subjects taught in industry.

It is difficult to identify subjects that will be of interest to a broad audience. Many companies need special training materials on unique subjects, such as a course in how to operate or repair a machine they manufacture. According to one study, 70% of the industrial training courses given are developed internally by company trainers. The reason for this is the need for specialized programs that only the company, with its unique expertise, can develop. But it is also a reaction to the fact that there are not enough packed or canned courses available.

The industrial training market is an excellent opportunity for some publisher or software house. With a little study, it would be possible to identify hot subject areas and market niches that need filling. When software becomes available, trainers will also buy micros. They don't buy movie projectors before films are available. And unlike schools which have tiny, limited budgets and complicated purchasing procedures, business and industry has money and efficient purchase practices. Industry is typically a lot easier to deal with in this regard than most educational institutions.

One company that has recognized the industrial training market is Bell & Howell (Chicago, IL). The company's Audio Visual Products Division, sells a modified and private labelled version of the Apple II computer as an industrial training device, just as it sells 16mm, slide and overhead projectors.

To take care of the lack of software, the company has developed PASS, the Professional Authoring Software System. This piece of software allows virtually anyone with a knowledge of the subject to develop a CAI program without having to know how to code in Basic or another computer language. PASS includes an authoring segment that allows you to write the learning material in English. Even high resolution graphics capability is included. PASS also includes a presentation segment that allows the material developed to be presented to the student. The management segment permits all forms of branching and record keeping for each student.

Finally, the reporting segment allows analysis of learner performance and keeps track of the success rate of the lesson material and the exams. An industrial trainer can create his own unique training programs. This is the type of authoring system that will help industrial trainers use micros. It will be interesting to see if any publishers or software houses also respond with CAI packages specifically aimed at the industrial market. □

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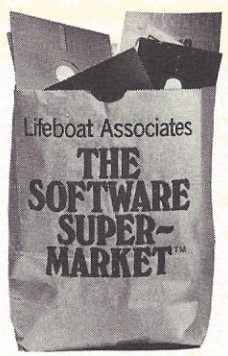

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As an example of what T/Maker II can do, see the chart below. The operator entered only the data shown in boldface. T/Maker II calculated and reported all the other values.

	— Actual —			Growth		Total	— Projected —		
	1978	1979	1980	Rate	Average	(000's)	1981	1982	1985
Item A	**42,323**	**51,891**	**65,123**	24.04	53,112	159.34	80,782	100,206	191,262
Item B	**45,671**	**46,128**	**49,088**	3.67	46,962	140.89	50,891	52,761	58,791
Total	87,994	98,019	114,211	13.93	100,075	300.22	131,673	152,966	250,053
% Item	48.10	52.94	57.02	8.88	52.69	158.1	61.35	65.51	76.49
% Item	51.90	47.06	42.98	-9.00	47.31	141.9	38.65	34.49	23.51
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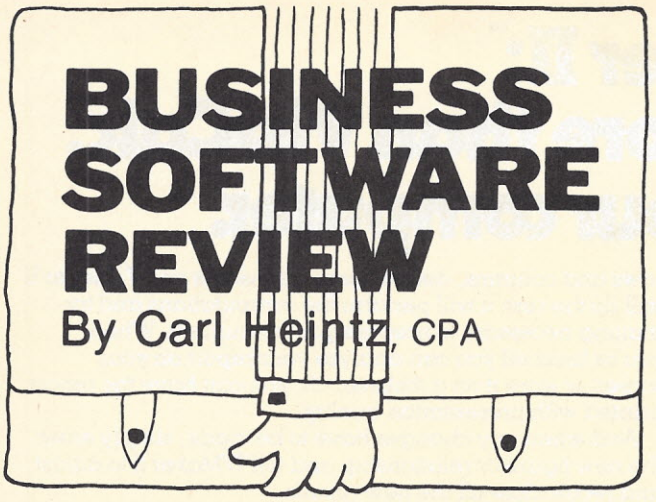


A Versatile File Management System

This month's column will review an excellent set of software from Systems Plus (Mountain View, CA) called FMS-80. The software is a file management system that will allow the user to create, maintain, query and produce reports from files without extensive programming. The system is designed to run on any 8080, 8085 or Z-80 system that operates under CP/M and has at least 48K of memory with a 24 by 80 character CRT with addressable cursor and clear screen features.

FMS-80 is modularly designed with three levels of complexity for the user to master. At the first level, the user learns to build and maintain files and perform simply inquiry and updating. At the second level, a host of new features is introduced, including: 1) sorting records on multiple keys (each key may be ascending, descending as necessary); 2) selection of records by multiple criteria for printing or sorting; 3) creation of sub-files of data that contain selected records and may contain only certain fields within each record desired; 4) definition of screen for the entry and display of data; 5) creation of report formats for use in printing records, which allows the use of preprinted forms, or the user can have forms created on the printer; and 6) creation of user menus of actions to be executed. In other words, FMS-80 allows the user to create turnkey applications programs.

Level III adds additional features including provisions for reformatting files to add or delete fields, combine two or more input files to derive output files, and perform arithmetic calculations on information in the data base.

The key to any good software is the documentation packages that accompany the software. FMS-80 includes a well-written and illustrated manual. Available as options to the packages are two VHS video tapes that contain a complete and exhaustive tutorial on data bases, programming and applications hints. The tapes are interesting from an educational standpoint alone, since they cover the methods of data base implementation quite well. The added demonstration of FMS-80 capabilities and hints of using the system are very helpful in guiding the user to a full appreciation of the system.

The hard-copy manual contains two sections—a user's manual and a reference manual. The user's manual is designed to teach the user how to utilize the package in a tutorial fashion. It contains a number of exercises with illustrations of what the computer should be doing for all of the commands entered. The manual is well written and about 50 pages long; it should take the average user most of a day to go through.

The authors wisely included a reference manual intended for those already familiar with the package. Over 100 pages long, this manual section includes a description of each major program function and includes details for applications, including examples. Data concerning the file structure and the interface with CP/M are discussed, along with details on how the user can customize the system. Also included are a handy error message section and a summary of the commands.

The package has some outstanding features that facilitate the entry and editing of data. When the system is in the input mode, it displays prompt lines for each field. The data field is defined by a series of dots, each one representing a data entry position within the field. If there were, for example, a 10-space field for City, ten dots would be displayed after the prompt for "City:". Various control codes can be used to correct the sequence of data entered. Control-U tells the system to clear the current field on the screen and to position the cursor to the first position of the field. Following a linefeed after Control-U fills in the current field with the last time data was entered in that field. Before final acceptance of any data, the system allows the user to correct any data field.

Basic details included

The system is one of the few programs on the market to actually give details about how to configure the program. Most of the other commercially available packages leave it to the user's imagination to format a blank disk, and then prepare it to receive copy of the applications program. The manual gives explicit instructions on how to set up the program from turning on the computer to setting the control codes.

There are numerous configurations that the user can make to the program itself. In the data entry section, the user can use a pre-defined data entry sequence that inquires about each of the fields in a record for data input, or the user can define his own data entry sequence. If a user opts to define a data entry sequence, a number of options are available.

The system allows the user to enter data in whatever order is convenient without regards to the order of the data in the computer records. Additional explanations and comments may be programmed into the computer to assist in the sequence. In formatting output, the user can invoke page numbering, print the current system date, or print special characters. Additional features allow the user to format the output by creating pictures of what it will look like. So numeric amounts might be represented as follows:

Data	Picture	Result
00123	$X,XXX,XXX.XX	$123.00
1234.45		$1,234.45

The programs have numerous utilities that allow the user to print out reports without going through extensive set-ups of report formats. For example, one program allows the user to print out the contents of a file while applying selection criteria, count the matches to the selection criteria, and produce a report based upon a user definition.

The HELP command provides the user with the ability to obtain explanations of selected items on-line. A limited help file is supplied with the system, and users are encouraged to add additional entries or to customize the help functions. To use a help file, the user invokes help and a screen hopefully containing the information requested is presented.

In the past, this column has featured a number of products that do the similar things as FMS-80. Some of the comparable products include TIM by Innovative Software, Selector IV by MicroAp, DBMS by Condor, and Analyst by Structured Systems. There are many differences between these products, and their features and capabilities vary widely.

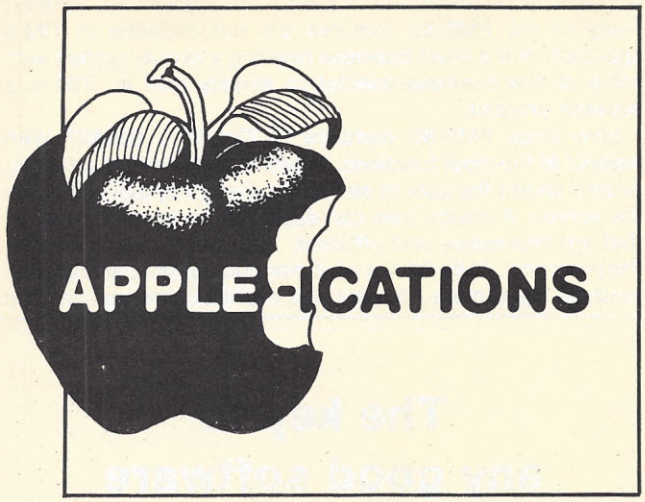
FMS-80 is not a simple set of programs designed for the first time user, despite the documentation. It is a very complex but immensely powerful set of programs, not dissimilar to Selector in complexity. The skilled user will be able to prepare a complete application program, such as accounts payable or accounts receivable, including menus and reports within a very short development timeframe. The finished product can be every bit as professional as a custom designed system.

Though the system is easy to get into, the novice user will have to spend considerable time learning all the ins and outs to fully utilize the power of the system. On the other hand, a program such as TIM, which is much more first-time-user oriented, is much easier to get into. The trade-offs are in reduced speed (TIM is written in compiled Microsoft Basic), with almost no ability to customize the application. Further, many of the FMS-80 features are not available in TIM's approach. For a small business needing a simple system with some of the business-orientation already built in, TIM is a superior product.

How does FMS-80 compare to Condor's DBMS? With respect to the input functions, DBMS is a lot easier to program, since it allows the user to set up the system by just writing on the screen. A novice user can easily set up input sequences that are impressive and efficient. Yet, on the report side of the programs, FMS-80 has a lot more going for it, since it can produce many more complex and sophisticated results from the data base. DBMS, however, allows the user to translate its files to those compatible with Basic, and thus could be interfaced with other programs to accomplish some of these tasks.

The key to any good software is the documentation.

FMS-80 is very much like a programming language—a fact that is appreciated the more a user gets to know the system. In that respect, it can be thought of as a higher level of programming than Basic. With its orientation, the ideal user is one who has some familiarity with CP/M and wants to produce professional quality finished applications programs with a minimum of detail programming. A computer consultant, a small systems house or a sophisticated user will appreciate the power this system can deliver. □



by Susan E. Luttner

CAI without Programming

When Ted Perry first applied for a federal grant to develop Block Author, he envisioned only a tool to help teachers design Computer Aided Instruction (CAI) for deaf children. That's why Block Author has no sound effects, and why it has such a complete graphics library and flexible graphics development system.

"Words are not the deaf's native language," explains Perry, a psychologist and manager of the computer project at the San Juan Unified School District in California's Central Valley. "Deaf children are used to using symbols. This program had to be able to use both."

Early in the planning stages, Perry joined forces with Geoff Zawalkow at the California School for the Deaf in Fremont. The two men determined that their authoring system would be so straightforward that teachers frustrated by other computer systems would use it in their classrooms. Three years later, Perry has realized that Block Author is a valuable CAI development program for all teachers, not just those in special education. It has been adopted for general use in 50 school districts and 6 university systems across North America. Perry estimates that hearing-impaired users account for only about 2% of the total audience.

Title IV-C earmarks its grant money for developing, testing or disseminating educational materials. Because the grant included no money for dissemination and field testing of Block Author, the school district has been conducting its own combination distribution and field tests, by selling the system to other school districts and asking for evaluations. "At this point," Perry adds, "I think we have disseminated greatly in excess of the average Title IV-C grant."

Developed under contract by Computer Advanced Ideas in Berkeley, CA, the program is designed for what Perry calls "a normal, human teacher," who knows little or nothing about computers and computer programming. It is not a programming language, but a program that leads the teacher step-by-step through setting up a lesson plan.

Perry admits that the program is not as powerful as PILOT, the standard language for education, but says it is much easier to use. In PILOT, the teacher has to structure both the lesson plan and the program; Block Author dictates the program structure and frees the teacher to concentrate on just the lesson. "I think there's a place for both," Perry says. "This system makes CAI available to computer novices who know more about education than programming."

Words are not the deaf's native language... Deaf children are used to using symbols.

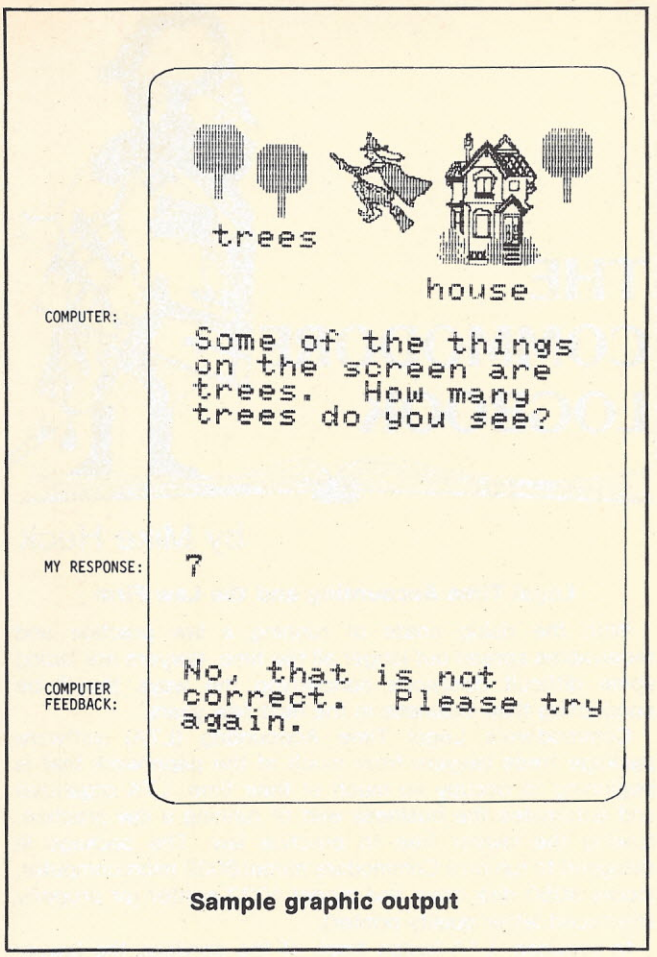
Block Author runs only on a 48K Apple II or II Plus with Integer Basic, dual disk drives, and game paddles or a joystick. Perry recommends using a color monitor, since the program has powerful color graphics capabilities. The 25-diskette system includes a 20-diskette graphics library.

The system is totally menu driven and prompts the user in what Perry hopes is clear, understandable English. Most teachers can write lessons after less than one day of instruction. Perry conducts a one-day workshop for each school district that buys the program, if the district will pay his travel expenses.

Each lesson development block begins by asking the user to define areas for graphics and areas for text on the screen. The game paddles or a joystick can be used to divide the screen into text and graphics windows.

Next the program asks for pictures. If none of the 600 images in the graphics library fits your needs, the graphics development diskette makes it easy for you to create your own. You can draw directly with game paddles, a joystick, or a graphics tablet. Rapid fill routines will color in even irregular areas, and shape commands will produce rectangles and circles in whatever sizes you choose. You can also incorporate images from the library or pictures you have drawn previously into a new composition.

Once the graphics are assembled and in place, the program prompts you to label them, then type in the lesson. The text insert routine has its own text editor. "We're not just worried



Sample graphic output

about bad typists like myself; we want teachers to be able to develop lessons right on the Apple.'' says Perry.

When you have signaled the end of a single question, the system will prompt you for a list of acceptable answers and the appropriate feedback for a correct response.

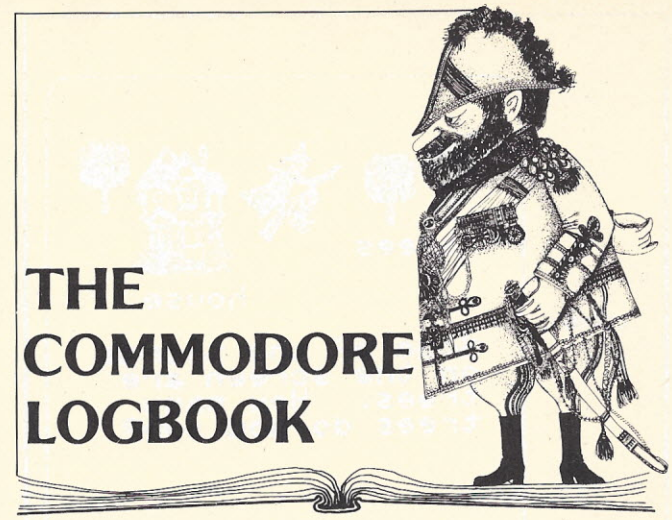
For both the lesson and the feedback text, you can use capital and lower-case letters, in two different sizes, in your choice of colors, and in two different character sets. You can choose from English, Spanish or Japanese character sets, or you can design your own—with or without pictures.

This graphics capability within the text simplifies CAI development for young children, who may need a combination of words and pictures. Perry regrets that Apple's DOS Tool Kit, which includes several foreign language and graphics development fonts, didn't come out two years earlier. ''I wish it had been around when we started this thing, because we spent so much time figuring out ways to do that.'' he sighs.

The program also records what wrong answers to expect and how to respond to each. Finally, it asks what response to make to an unexpected wrong answer. That settled, you have completed one block. You can then string together these blocks into lesson plans.

When the student later runs the lesson, the program automatically stores performance data. It will customize the lesson plan for each student according to your specifications, and it will repeat lessons until a student has performed at an acceptable level. But the program cannot branch. ''That's another reason why it isn't as powerful as PILOT,'' Perry says. ''It can proceed only along a linear path.''

The San Juan school district sells the program to school districts and institutions with full rights to copy all programs within the district. ''We're not a business, we're a school district,'' Perry points out. ''If this is a useful program, we want it to get out.'' Because the program was developed under a federal grant, any income from sales goes into the computer project at San Juan. □



THE COMMODORE LOGBOOK

by Mike Heck

Legal Time Accounting and the Law Firm

With the rising costs of running a law practice and receivables spread out longer all the time, lawyers are facing some difficult decisions concerning the ways they'll be conducting their business in the next few years.

Commodore's Legal Time Accounting (LTA) software package frees lawyers from much of the paperwork that is beginning to occupy so much of their time. LTA organizes and automates the business end of running a law practice, leaving the lawyer free to practice law. The package is designed to run on a Commodore model 8032 microcomputer, model 8050 disk drive and model 4022 printer (or properly interfaced letter quality printer).

In essence, LTA keeps track of the services the lawyer performs for his clients and handles billing automatically. The system can also be used to see instantly who is performing what services within the firm, for which client, and how much of the lawyer's time each client has used.

The system is easy to use, even for those with little or no computer experience. Entering and retrieving information is accomplished simply and quickly. Clear, step-by-step instructions make it easy to select the desired function and perform it correctly. The system closely follows the normal office routine—no real change in office procedure should be necessary. The user can set up unique activity and fee codes, reflecting the special services the law firm may perform.

LTA is menu driven, but with an important difference. First, the user selects a numbered item from the main menu. As a data entry mask or other form is displayed on the top portion of the screen, the bottom section (separated by a bar called the Decision Command Line—DCL) shows additional options (see figure).

This way, the operator can see exactly what information is being entered, and what options are available to manipulate that information. It eliminates the need to go through many sub-menus to enter or change data.

As shown in the figure, the user is presented with a mask to fill in information about the client. Under the DCL, options are presented to add new clients, change current data, delete a client or exit to the main menu. The user just types in the information required. Editing can be done as the information is entered using the keyboard editing keys, or later using the change option.

Along the way, under the DCL, the system prompts you further in plain English to make sure you don't make a mistake. In critical areas like changing diskettes, the user is presented with a special graphic of the disk drive, indicating the proper diskette to insert or remove at the appropriate time.

These features were incorporated to catch potential errors and make the system easy to learn for first time users. Other LTA functions take on this same form: the user is presented

with the appropriate mask or questions and corresponding options under the DCL.

In the main menu, client and case information are entered first. Matter File Maintenance creates a matter (case) record whenever a client is accepted, or new matter is handled for an existing client. Once that is done, the lawyer completes an activity for a client, he jots down all the pertinent information such as matter number, time spent and activity code on a pre-

```
                    << Client Data Entry >>

      1.)  Client's Name:    ..............................
      2.)  Phone Numbers:    .........
      3.)                    .........
      4.)          Address:  ..............................
      5.)                    ..............................
      6.)             City:  ................
      7.)            State:  ..
      8.)              Zip:  .....
      9.)      Lawyer Code:  ...
     10.)      Client Type:  ....
-------------------------------------------------------------------------------
    Current Balance       30 days        60 days        90 days
          0.00              0.00           0.00           0.00
===============================================================================
                          Selection ?
        A Add to client list              E Exit update mode
        C Change Client data              D Delete a client
```

Client file maintenance screen

numbered log sheet. At the end of the day, or at any convenient time, the files are updated, using the information entered on the log sheets.

In this, Log File Maintenance selection fees are automatically calculated. For example, if 2.5 hours were entered for an activity that the user defined as $60/hour, the system would charge $150 to the account. The remark field in the log Entry section can be printed out on statements, providing a convenient way to itemize services. Log File Maintenance is also used to record payments.

However, the real power of the system is what happens to the information from that point. The program acts as a billing system capable of printing statements that can be tailored to show, in a number of different ways, how clients are being charged. Statements can be printed in eight different formats, on a client-by-client basis. Statements can range from no statement being sent to a detailed statement being sent for all matters, with complete aging. This selection is made during client data entry and can be changed at any time.

Before printing statements, the Post Log Entries selection automatically matches all open logs with the appropriate matter and client, and updates receivables balances. LTA supports most popular letter quality printers with either continuous stationary or hand-fed letterheads.

The system also provides an ability to sort and print out information in a useful form. It keeps track of client lists, matter lists and all log entries associated with a particular case.

Print/Display Clients and Print/Display Matters provide a listing of either client or matters on either a selective basis or the entire list.

The Client Matter Inquiry selection shows exactly what services were performed and how much was billed for the service, including totals for the period and amount billed-to-date for the matter. This detailed but understandable display is designed to quickly show billing history. Payments will be shown as credited to the account.

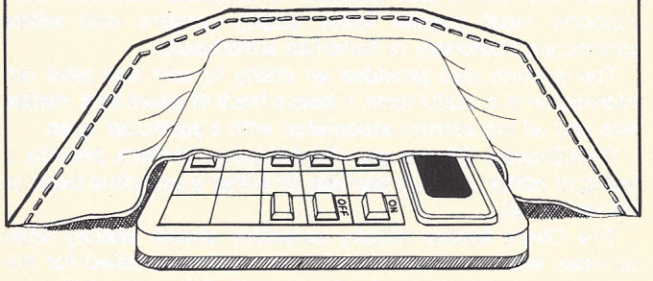
Statistics Reports let you know exactly what is occurring within the firm. Among the kinds of reports LTA provides are summaries of activities by firm, by lawyer or both. The system also provides aging analysis by the same criteria. A utility section lets you set up, and later change, fee codes, lawyer codes, as well as other seldomly changed items such as printer type.

Diskette Backup copies diskettes to guard against loss of data. Interface Menu provides for linking LTA to other systems.

The package can be effectively used by a firm of up to 10 lawyers. Approximately 500 active clients, 1,500 open matters and 2,500 outstanding log entries can be handled. □

POWER IN YOUR POCKET

by Bob McElwain



Pocketful of Miracles

Handheld computers will be fundamental to the computer age. Big computer systems will continue to have their way with us. But a million people with a computer in their pocket are a different sort of power. Handheld computers give personal computing a brand new meaning. Future sociologists may need to define the social impact of computers as stemming from two distinct sources—handheld and "other" computers.

Many engineers and other technical types need computing assistance throughout their work day. These people know enough about programming to write what they need. For the moment, they are the typical owners of the first handheld computer—but only for the moment.

The handheld computer will be a tool for almost everybody —not just specialists. Software is the key. When good programs become available, the average consumer will jump on the pocket bandwagon.

Another key to the future success of the handhelds is portability. In the dark depths of a coal mine in West Virginia, on a small sloop headed for the Orient or atop a high-rise construction project, the pocket computer will be clearly in evidence. This monthly column will focus on the latest hardware and software developments in the fast-growing and dynamic pocket computer arena.

The TRS-80 Pocket Computer is a useful and highly efficient tool—if you're a good programmer. Writing programs will be difficult unless you already have some skill with Basic.

Radio Shack (Fort Worth, TX) has announced a few packages available on cassettes. There'll be others. And other vendors will soon offer usable programs. But the watchword is wait—wait until the product you need can be demonstrated. The current Radio Shack packages include business financial, statistics for business, marketing and sales, real estate, aviation, civil engineering, personal finance, games and a math drill.

The bad news about the TRS-80 pocket computer begins with the manual. It's good, but a little overpowering. There is little help for the beginner. Two books are suggested, to make up the difference, but they can't do the job. The novice will need other sources.

Other drawbacks include: tedious programming; difficult and slow code entry and a primitive Basic. A syntax check on input would help. Serious or extended programming effort is not worthwhile unless the results will be used repeatedly.

You will need a cassette interface for the following reasons. If you buy programs, an interface and recorder will be required to load the cassette tapes. Also, if you have loaded a program through the keyboard, and finally got it running, you won't want to lose it. Finally, it's impossible to predict when batteries will fail. (Murphy would agree they'll fail at the worst possible time.) Whether you buy programs or write your own, you'll need the backup only cassettes can provide.

Most audio cassette players will work. Since the tape can hold many programs, it helps if the unit has a counter. Radio Shack sells good units and other brands are plentiful. For those on the move, a portable unit may be the answer.

Hand me a new computer and immediately I want to stuff it with a game before getting down to serious work. But there's no random number generator on the TRS-80 pocket computer.

Never having faced this situation, I was stumped. I dug into and poked around my library for more time than I care to admit. But I did learn a little about generating pseudo-random numbers.

I settled on the power residue method. It gives a long run before repeating and the numbers generated pass a lot of the tests for randomness. Listing 1 utilizes this method in generating a hundred pseudorandom numbers.

Following is a list of variable definitions.

M = (Initially) An odd integer as seed.
(Subsequently) A pseudorandom number generated between 0 and 1. Note that M must not be modified by the main program. Other variables within the subroutine have only temporary values.

A = M*65539 where 65539 is a machine dependent constant in the form of $8*J \pm 3$. J is an integer such that $8*J \pm 3$ is as close as possible to 2 EXP(K/2) where K is the bit size of the processor. The TRS-80 pocket computer is not a 32-bit processor, but in computation it acts like one. 2 EXP33 displays as a ten digit number, while 2 EXP34 displays in exponential form. I used this fact and selected constants for a 32-bit processor.

B = A*2 EXP(K – 2). A is transformed into a floating point number with the decimal part a pseudorandom number between zero and one.

When you buy a computer, you're supposed to read the manual. I did, but I missed a program in the back called Random Numbers. The program generates pseudorandom numbers with the Congruence Method. Having written my own routine, I just had to test it against the routine in the manual. Space and time were about the same; it looks like a toss-up from here.

Algorithms to produce pseudorandom numbers are subjected to extensive testing before being accepted by serious users. One factor considered is the point at which the routine degenerates into repetition. If the constants I used are correct for the TRS-80, the method will not degenerate in half a million numbers.

Another test of importance is the degree of randomness in the numbers produced. Using a larger computer, it would be interesting to test the method in the Radio Shack manual against the method I used.

Snap, crackle and crunch

Tom Fox reported on his efforts to upset various computer folks with a simple looking benchmark program (IA Jun 80). His "Prime Number Cruncher" does indeed crunch. He reported the details of runs on several computers. If you don't believe this is a ruthless time test, try it on your favorite computer. You too will become at least anxious before the last prime is printed. Listing 2 demonstrates the run I made on the TRS-80 pocket computer.

I used letters at the end of the alphabet. The TRS-80 can find these letters about 20% faster than letters from the first of the alphabet. I used a BEEP and PAUSE instead of PRINT. This takes less than a second. The extra time over a fast printer is of no significance here. I used 999 as the upper limit for Y (instead of 1000), because this is the maximum for a loop parameter.

The program executed in 55,830 seconds. If this sounds slow, try it on your computer. Of the computers reported in the article mentioned above, the slowest was an 8-bit micro at 1,928 seconds. This is about 29 times faster. The average time for ten 8-bit micros was 1,330 seconds—about 42 times

faster. Clearly the TRS-80 pocket computer is slow. There's a reason.

The computer weighs about six ounces. It draws only eleven milliwatts, hence the long run of 300 hours on a set of inexpensive batteries. These features can't be wrapped in fast technology. The trade-off is speed and power versus portability. There are many applications where the features of this computer far outweigh any speed disadvantage.

Incidently, the fastest time reported for the benchmark program was on a Digital Equipment PDP-10. This 36-bit processor managed the task in only 65 seconds. This is a whopping 859 times faster. Of course the PDP-10 draws something more than 11 milliwatts. And it costs a bit more. But most importantly, you can't put a PDP-10 in your pocket. □

Listing 1

```
Use subroutine "RANDOM" to generate
100 pseudorandom numbers between
zero and one

   - Get initial seed number
 5: GO SUB 905
   - Loop for 100 numbers
10: FOR Z = 1 TO 100
   - Get one number
15: GO SUB 925
   - Display number returned
20: BEEP 1: PAUSE "M=";M
25: NEXT Z
30: BEEP 5: PRINT "DONE"
35: END
```

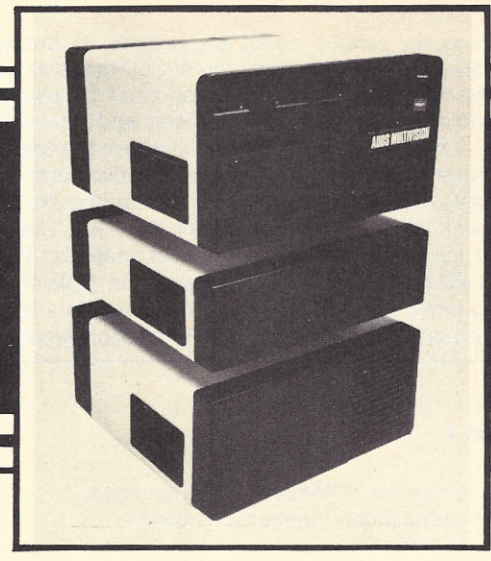
```
SUBROUTINE: RANDOM

   - Seed must be an odd integer
905: INPUT "ODD #?";M
   - Is input an odd integer?
910: M = INT(M)
915: IF INT(M/2) = M/2 THEN 905
920: RETURN
   - Entry point to get a number
925: A = M*65539
930: B = A*.4656612873
   - Get decimal part of B
935: M = INT(B)
940: M = B-M
945: RETURN
```

Listing 2

```
 10: PRINT "STARTING"
 20: FOR Y = 1 TO 999
 30: FOR Z = 2 TO 500
 40: X = Y/Z
 50: W = INT(X)
 60: IF W = 0 THEN 110
 70: IF W = 1 THEN 100
 80: IF X > W THEN 100
 90: IF X = W THEN 120
100: NEXT Z
110: BEEP 1: PAUSE Y
120: NEXT Y
130: BEEP 5: PRINT "DONE"
140: END
```

ADDS Multivision



by Tom Fox

ADDS (Applied Digital Data Systems, Hauppauge, NY) makes computer terminals, the cathode-ray tube (CRT) kind that have become as much a part of today's modern computers as RAMs and ROMs, benchmarks and bugs. To many, the terminal *is* the computer; the part that is right out in front of the computer user, the component that is seen and touched every day. ADDS has become the world's largest supplier of terminals for the OEM market. Computer manufacturers would buy ADDS terminals, often adding their own nameplates, and re-sell them as a part of their systems.

But whole *computers*? What experience does this manufacturer have in constructing the entire complex of machinery that makes up a computer system? Here's a little-known fact: Radio Shack's initial foray into the big microcomputer market was accomplished with ADDS equipment. In the days when the model I was the *only* TRS-80 (there are now five), Radio Shack opened the first of many stores that specialized exclusively in computer systems. Its top-of-the-line offering: the Tandy 10. Soon to be phased out in favor of "pure" TRS-80 equipment, the Tandy 10 was, in reality, a privately-labeled ADDS system 70.

The current microcomputer offering from ADDS is the Multivision lineup, related only distantly to the nearly seven-year-old design of the system 70.

When we first saw the Multivision computer, over a year and a half ago, the system was scattered: a rat's nest of wired-together breadboard in one room; experimental software running on an earlier generation of hardware in another; a hand-carved plastic enclosure undergoing final trimming at a model shop across town. The far-flung pieces were held together with an idea—a concept for a compact, modular microcomputer system that could expand and grow in pace with the expanding needs of the purchaser. There was a lot of uncertainty about how to market the new product, but the computer's concept was exciting, and the company behind it was certainly capable of following through with its soundly conceived product idea.

In the intervening months, we have seen Multivision fulfill two-thirds of its initial promise. The "starter" floppy disk-based Multivision 1 is being shipped in quantity, as is the 10M-byte add-on Multivision 2. The crowning Multivision 3, a multi-user extension to the 1 and 2, is just now beginning to trickle through the distributor/dealer network on its path to the end users. Along the way, the product line has collected some unplanned-for assets that were but dreams when the computer was first conceived: a VisiCalc-lookalike financial planning language and extremely fast Basic compiler.

The Multivision 1 is a compact, cube-like box crammed full of computer parts. It is a solid plastic and sheet metal construction that somehow manages a distinctive appearance despite its boxy dimensions: 15½-in. wide and deep by 8½-in. high. Behind the black front panel are the two visible minifloppy diskette drives, a modular power supply and a card cage containing the computing electronics. The only controls, visible or invisible, are a pair of pushbuttons in an upper corner: a combination power switch/pilot lamp and reset button for re-booting the system.

The disk drives accept a pair of double-sided, double-density 5¼-in. minifloppy diskettes. Each can hold 350K bytes of data, giving a total capacity of 0.7M bytes of storage. The drives feature a track-to-track seek time of 5 mS, yielding an average access time of 60 mS—about average for minifloppy hardware.

The interior card cage will hold four 8½-in. by 13-in. circuit cards, each of which plugs into a 100-pin connector on the vertically-mounted mother board. The cards do not conform to any industry-wide bus standard. The basic Multivision 1 complement includes three cards: a central processing unit (CPU) and serial input/output (I/O) card, a diskette drive controller and parallel I/O card, and a random-access memory (RAM) card.

The CPU utilizes the increasingly popular 8085 microprocessor, operating at a swift 5 MHz rate. Extensive direct memory addressing (DMA) circuitry is provided, speeding up data transfers to and from the system disks, terminals, printers and other peripheral devices. This circuit card contains a 4K-byte read-only memory (ROM), which holds the bootstrap program and remarkably extensive set of start-up diagnostics routines. During the boot-up process, the system hardware undergoes an automatic 15-second test of the memory, I/O electronics, and disk drives. Both "soft" and "hard" errors are detected and reported, in many cases including the location of the plug-in card,

which is the most probable cause of the trouble. The boot-up/diagnostic ROM is connected in shadow mode (sometimes called phantom); thus it effectively disappears from the main RAM's 64K-byte address space when its brief task is completed.

The main CPU card also contains I/O circuitry for a pair of asynchronous serial communications ports, which conform to the standard EIA RS-232C convention. Maximum data transfer rate on these is 9600 baud. One of the serial ports is intended for the system's CRT terminal; the other appears to have no function as yet, at least with the standard ADDS software.

It takes a while to notice that the computer is missing that sprinkling of tiny dual inline package (DIP) switches that usually populates the insides of computers these days. These switches are normally there to configure the computer to the individual vagaries of terminal baud rate, printer peculiarities, RAM configuration, disk drive addressing, etc. In the Multivision 1, all of these switches have been replaced with a single 256-byte RAM that contains all of this data in software look-up tables. The information is placed in the RAM via program routines, and is held there with a tiny current from a tiny lithium dioxide battery soldered into the board. The battery/RAM combination is capable of remembering the software switch settings for months at a time, even with the card itself removed from the computer.

The second circuit card within the Multivision 1 is primarily a dual-density minifloppy diskette drive controller. In addition, this board contains a pair of quite different parallel I/O ports. Both are intended for connection to printers. One of these is a standard 8-bit port, designed for connection to Centronics-compatible printers. The other is termed the "13-bit port." This one will work with the parallel I/O versions of Diablo, NEC and other word processing quality units.

A 64K-byte RAM board finishes the complement of plug-in circuit cards. The memory is organized into four 16K-byte banks. One of these is designated as home for the MUON operating system; the remaining 48K bytes are available for the user's programs and data. In the multi-user arrangement that comes with Multivision 3, this concept is extended to give each of four users an independent 48K-byte area for working. Because memory cards come only in 64K-byte chunks, the addition of the second through fourth users liberates a 16K-byte bank of memory for each. This space can be utilized by the Multivision 3 to run background jobs, such as the printer spooler.

The memory design utilizes dynamic chips, holding nine bits of data for each 8-bit byte. The extra bit allows for parity error detection on each memory access. When errors are detected, the affected 16K-byte bank is switched out. If available, another bank is allocated to the task, which can hopefully be restarted without affecting other users. The next boot-up process will cause the offending bank to be reported as a part of the automatic diagnostic procedure.

The Multivision 2 is really an add-on disk drive housed in a cabinet obviously styled as a part of the Multivision family. This unit is a box just an inch lower than the parent Multivision 1, and designed to neatly slip underneath it. A set of extremely short cables joins the two units into a perfectly cubical black-faced monolith.

The added disk drive is the Shugart 1004, a 10M-byte machine spinning 8-in. diameter hard disks. This is a variant of IBM's Winchester design, which encloses the disks in a hermetically sealed womb. The arrangement provides the ultimate in protection for data, but carries a penalty in operator convenience when it comes time to back up the programs and other data. This function must be performed with minifloppy diskettes; it would take at least 29 of them to copy the complete contents of the hard disk—an hours-long procedure. The Multivision catalog lists no way to extend its mass storage capacity beyond the 10.7M bytes contained on the pair of floppies and single Winchester.

Multivision 3 is the final touch; the link that transforms the computer into a multi-user machine. Physically the smallest of the trio, it is designed to slip between the two other units, and connect via a set of cut-to-length cables. Versions of the Multivision 3 are available to extend the system to two, three or four users. The box contains a four-port serial I/O board, as well as the appropriate quantity of RAM, 64K bytes for each user. Also included is the multi-tasking version of the MUON operating system to orchestrate the effort of the 8085 microprocessor chip.

The hardware side of the Multivision lineup is rounded out with a generous selection of ADDS CRT terminals. These range from the relatively basic M2010 terminal to the full-featured M6210 device. The latter is optimized for use with the Multivision word processing program, including no fewer than 28 special keys dedicated to this function. ADDS does not supply printers, but allows its dealers to select that essential component and mate it to the system at a local level. With the rich variety of I/O ports available on this computer, the choice of printers is almost a free one.

The original Multivision concept, handily achieved, is to allow a user to begin with the Multivision 1, grow into the additional mass storage of the Multivision 2 hard disk, then ultimately branch out into a full multi-tasking system with the Multivision 3. At no point does the user have to scrap any hardware in order to achieve this metamorphosis. Applications software, however, may have to be upgraded with file locks to keep the various users out of each other's data files.

MUON, or Multi User Operating Nucleus, is ADDS' own operating system, utilized exclusively in the Multivision product line. MUON is advertised as being CP/M compatible, promising that any program (including any programming language) designed to run on Digital Research's CP/M operating system will work as well with this equipment. In addition, MUON includes a bagful of multi-tasking and background processing tricks that extend well beyond the CP/M kernel. These are partially deactivated in the single-user Multivision 1.

An ADDS adaptation of Microsoft Basic interpreter (version 5.0) is the standard programming language for the Multivision product line. Microsoft's compiler for this language is also available. The interpreter version performed our Prime Number Cruncher benchmark program (IA Aug 81) in 766 seconds, a very respectable mark for an 8-bit micro.

For advanced business programming, ADDS offers a sophisticated file handling adjunct called the indexed-sequential access method (ISAM). ISAM allows the applications programs to locate and read data records in an organized manner much more quickly than with the techniques available in normal Basic.

ISAM methods have been used extensively in ADDS' accounting software packages. The accounting packages include modules for accounts receivable, accounts payable, inventory control, order processing/invoicing and general ledger. Several links exist between these programs, tying them together into an integrated business management system.

A new program called FPL (financial planning language) puts ADDS squarely into the middle of the Visi-clone bandwagon. FPL, written by C4P of Van Nuys, CA and distributed by Lifeboat Associates of New York, is described as a "computerized columnar spread sheet" with a "visible calculator" mode.

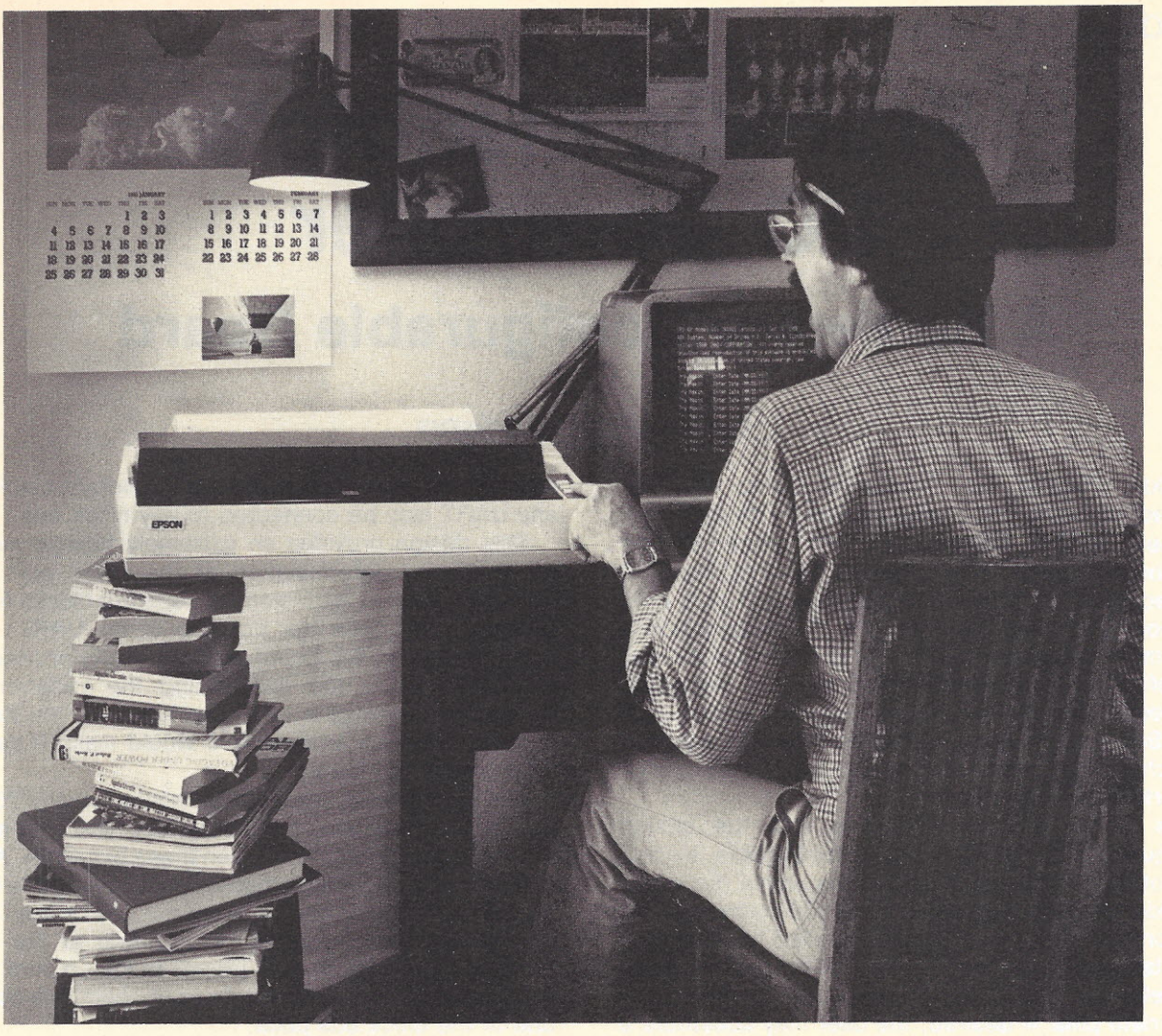
The word processing program available on the Multivision is one of the most extensive we have seen on a microcomputer. This program is an adaptation of a years-old ADDS product, so there has been plenty of time to work out the bugs. Being a designer and manufacturer of terminals, ADDS has the advantage that the word processor and terminal keyboard could be designed together to optimize the human/machine interface.

ADDS has paid the appropriate attention to user documentation. The owner's manual is detailed enough so that the electronically inclined soul can set up Multivisions 1, 2 and 3 right out of the shipping carton. The book also covers board-replacement troubleshooting techniques to a greater depth than is normally found with documentation supplied with this class of equipment. Basic manuals are quite complete, and the MUON description is probably more detailed than is needed by most users. The word processing manual is targeted to the first-time-ever computer user—probably an excellent guess at many installations.

Pricing for the Multivision product line is straightforward, and follows the modular concept of the hardware pieces themselves. The basic Multivision 1 lists for $3,785. Adding the Multivision 2 hard disk subassembly brings this up to $8,595. The Multivision 3 comes in three varieties yielding a two-, three- or four-user system. The total for a Multivision 1/2/3 equipped for two users will cost $10,365; for four, $12,885.

CRT terminals range from $1,045 to $1,495, and we're reasonably sure the new $650 Viewpoint will work as well. Clever purchasers will discover that, as with most microcomputer systems, CRT terminals built by other manufacturers can be made to work.

All software is priced separately. The MUON operating system costs $150 for the single-user system, $600 for the multi-user version. Different versions of Basic (some including ISAM and all including MUON) list for $300 to $675. ADDS' word processing program costs $425, and really works best when accompanied by the most expensive of the terminal options listed. □



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Needless to say, the specs on this machine — and especially at under $1000 — are practically unbelievable. But there's something about the MX-100 that goes far beyond just the specs; something about the way it all comes together, the attention to detail, the fit, the feel. Mere words fail us. But when you see an MX-100, you'll know what we mean.

All in all, the MX-100 is the most remarkable printer we've ever built. Which creates rather a large problem for those of us at Epson.

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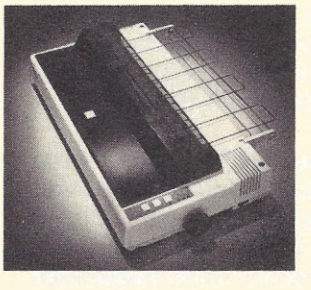

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Franklin Electric's I/O Controller

A Hardware Configurable Board

by Roger H. Edelson

Franklin Electric Co., Thousand Oaks, CA, has achieved versatility and configurability by designing an extremely flexible serial/parallel I/O board for the S-100 bus computer. This is the I/O board to choose if it is necessary to emulate a particular I/O port configuration, as either Altair or 3P + S compatibility is user-jumper selectable. With just a little thought and some effort, one can set this board up to be compatible with North Star I/O standards. I use the board as a North Star I/O emulator and after having conducted some changes, I own a very reliable board that mimics the North Star conventions.

Let's review the specifications and the design techniques. The interface is user-strapable to any group of eight contiguous addresses within the entire port address space allowed by the S-100 machines. The lower order three bits (0-2) are decoded to determine the 8 status and data ports, while a 14-pin socket allows easy selection of the board address by jumpering the appropriate pins. If desired, the user may substitute a DIP switch for the header and jumper design, making it easier to set up and change the board addresses.

The tables provided in figure 1 show the board addressing capability and the internal port decoding structure. Note that the board may only be moved in Mod 8 steps, ie. you can't position the starting address at 07H. This is no particular problem in any conceivable system. However, as the internal decoding is determined by an LS42 3-to-8 decoder, modifying this arrangement requires some thought.

If your computer is equipped with facilities for utilizing vectored interrupts with your I/O routines, the Franklin I/O interface may be strapped to drive the S-100 VI0-VI7 lines in any desired combination. To do this, one must use the pads placed in the lower left corner of the board, near where these lines exit the board.

This board provides the inverse arrangement of the old 3P + S board; here we find the much more useful 3S + P arrangement. Each of the serial ports may be setup for either current-loop or EIA RS232 interface levels, and a nice touch is provided in the technique used for baud rate selection.

The 16X clock needed by the UARTs to control the baud rate is derived by a chain of four LS163 4-bit counters. While this requires a few more chips than if one would use the now available IC baud rate generators, it has the advantage that all the various clock frequencies are available simultaneously. This architecture, in conjunction with the pad arrangement for the bit rate jumpers, allows the user to have three baud-rate busses —A, B, & C. Each bus may have a different clock, and any UART may be connected to any clock bus.

This design provides an extremely flexible method for hardware determination of the serial port baud rates. There is no provision for separate clocks for the receiver and transmitter portions of the UART, but a small amount of PC board surgery would provide this capability. Once the line joining the receiver and transmitter clock pins had been severed, the flexible clock distribution arrangement would make it easy to incorporate this feature.

The baud rates available range from a low end 75 bits/sec. to the maximum of 9600 bits/sec. and encompass all the standard values between these extremes. Again, an enterprising hardware hacker could obtain the faster 19,200 bits/sec. rate, if required, by some minor alterations. This frequency is available at the clock input (pin 2) of the second LS163 in the counter chain (IC29) and it is only necessary to connect this point to one of the clock bus pads.

In keeping with the hardware configurability of this board, the bit rate and other UART options (parity, word length, and number of stop-bits) are selected with an easily changed 16-pin socket/header for each port. I replaced the socket/header combination with a DIP switch, making setup and change even easier. The board is normally configured for full-duplex operation, though half-duplex mode for any (or all) of the serial ports may be enabled with a single jumper per channel. The Receiver Data Available and Transmitter Buffer Empty signals from the UARTs are provided for handshaking and port control. A jumper selectable section allows the user to configure these signals to be either 3P + S or Altair compatible. This flexibility is achieved by providing six inverters and the pads for either inserting them or bypassing them in the signal path; very simple—but effective and useful. In addition, three spare EIA drivers and three spare EIA receivers are provided for user-defined software control of data-set-connection using the parallel port.

The parallel I/O provides one input/output port and one input status port for DATA REQUEST and DATA AVAILABLE plus six user-option spare status bits. The parallel output data is latched with a pair of LS175 Quad D-Flip/Flops, while the input data is not latched—a minor inconvenience. Both the input and output parallel ports are TTL compatible, but no signal buffering is provided. It might have been useful to provide drivers on the output lines and bus-receivers to unload the input lines, easing the interface problem for the user.

I received the board as a kit, which turned out to be one of the easiest that I had to assemble. The assembly portion of the manual is in keeping with the tradition established by the small-computer industry—skimpy—but adequate.

The board is well constructed with good, legible silk screening and good etch work and pads. Low-Power Schottky circuits have been used for all the logic, and the rest of the components are of good quality. Franklin Electric, like many others, uses DIP-sockets for cable connectors. Four such connectors are provided, two for the serial I/O and two for the parallel I/O. These

Address Bit	Socket S4 Marking	Pins Jumpered for Zero
A3	"A3"	1 to 14
A4	"A4"	2 to 13
A5	"A5"	3 to 12
A6	"A6"	4 to 11
A7	"A7"	5 to 11

I/O INSTRUCTION DEVICE ADDRESS								PORT SELECTED
A7	A6	A5	A4	A3	A2	A1	A0	
					0	0	0	Serial I/O Port 1 Status
					0	0	1	Serial I/O Port 1 Data
			User selectable		0	1	0	Serial I/O Port 2 Status
			32 possible		0	1	1	Serial I/O Port 2 Data
			combinations		1	0	0	Serial I/O Port 3 Status
					1	0	1	Serial I/O Port 3 Data
					1	1	0	Parallel I/O Port Status
					1	1	1	Parallel I/O Port Data

Figure 1. Board and port addressing

I/O INSTRUCTION DEVICE ADDRESS								PORT SELECTED
A7	A6	A5	A4	A3	A2	A1	A0	
					1	1	1	Serial I/O Port 1 Status
					1	1	0	Serial I/O Port 1 Data
			User selectable		1	0	1	Serial I/O Port 2 Status
			32 possible		1	0	0	Serial I/O Port 2 Data
			combinations		0	1	1	Serial I/O Port 3 Status
					0	1	0	Serial I/O Port 3 Data
					0	0	1	Parallel I/O Port Status
					0	0	0	Parallel I/O Port Data

Figure 2. Showing inverter port selection

types of board interface connectors are not my favorite, particularly if there are many cable insertions/removals. I much prefer Molex style or flat-cable type connectors and wish there had been some way to modify the board to accept these style connectors. To be fair, I have not yet experienced any difficulty whatsoever with the DIP connectors.

The circuit design supports the principle of flexibility, which is the hallmark of this interface board. For the serial ports, both current loop and EIA RS232 conventions have been provided with standard IC RS232 drivers/receivers used for that configuration. Jumpers are used to select the desired serial interface levels. No provision or mention is provided for the use of response control components to tailor the operation of the 1489-RS232 receiver, and indeed in most cases these components are never required. To aid in trouble-shooting, LED indicators have been provided on each of the serial input and output lines. These devices are a real help when first setting up the board, as they provide a partial stand-alone self-test capability.

As mentioned before, spare EIA drivers and receivers are provided for instances where a Data-Set or modem must be monitored and controlled. A small section of the manual is devoted to suggesting some possibilities for the use of these devices, though, as the manual states "...applications and requirements vary widely." The manual also provides a table of 10 of the EIA RS232 handshaking signals with a description of the communication convention describing signal direction. This list of signals is not complete, but it covers those needed in asynchronous communication; the signals used for synchronous data interchange are not included, as this board will not support that mode.

The rest of the circuit design is relatively conventional; MM5303s are used as UARTs and most of the S-100 signals are buffered. Only the SINP signal is required to drive more than one gate; it must drive three. This could have been prevented by routing the signal through a spare 8T97 buffer circuit, which is available on the board. All of the DI lines to the CPU are obtained through DM8251 8-INPUT/1-OUTPUT multiplexers, which are controlled by the lower three address bits, A0-A2.

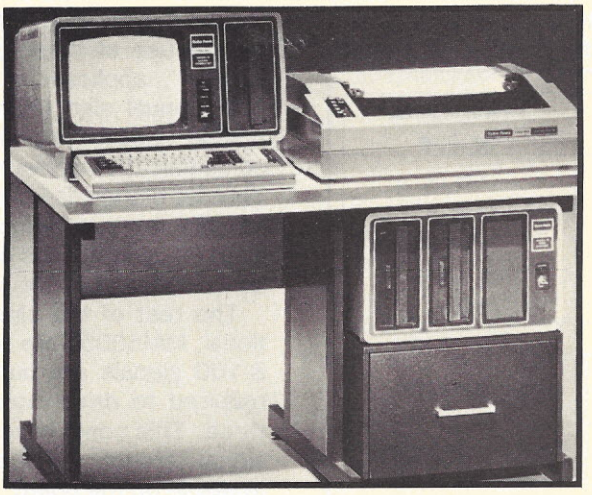
As Franklin Electric had thoughfully provided two spare buffer circuits, I was able to use them to make the board compatible with the North Star I/O conventions. I replaced one of the 8T97's (IC 28) with its inverting cousin (the 8T98), which allowed me to invert the port select table from the configuration of figure 1 to the one shown in figure 2. I had to use the two spare available circuits (now inverters themselves) to re-invert the DO lines, DO0 and DO1, which had been inverted with the substitution of the 8T98. The insertion of these inverters into the signal path is where most of the adaptations were confined, but it was relatively easy. This was followed by some minor changes to the arrangement of the status signals, all of which were manageable using the very flexible jumpering architecture provided by the board design. I'm quite sure the board designer had not expected that anyone would make these types of changes to the board, but the fact that flexibility and adaptability were the principles underlying the board design makes it very suitable for this kind of modification.

The manual provided with the board is quite complete and can almost double as a useful primer for UART operation. All the UART options are described as well as full and half-duplex operation. Appendix-A covers test programs, which permit the user to check operation of the board. The programs are kept short, but still provide sufficient testing to assure correct board operation. These programs assume that the computer possesses front panel switches and lights, and therefore they would have to be rewritten if these conveniences are not available.

If you are expanding an existing system, or converting an old one, and need to modify your I/O configuration, this is a board definitely worth considering. □

CIRCLE INQUIRY NO. 1

Radio Shack TRS-80 Model II—



Getting Down to Business

C-3

	Accounts Receivable Time	Current Price
Radio Shack TRS-80 Model II	3:36.8**	$ 7,609
Pertec PC 2000	6:04.3	$12,470
DECstation 78	5:04.8*	$10,495
Vector Graphic System B	5:56.5	$ 8,995
Texas Instruments Model 771	3:38.1	$12,100
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$ 9,275
Apple II Plus		
Digital Micro Systems DSC-2		
Data General	*to be covered in future issues*	
Alpha Micro		
Ohio Scientific		

*Includes both compile and run time

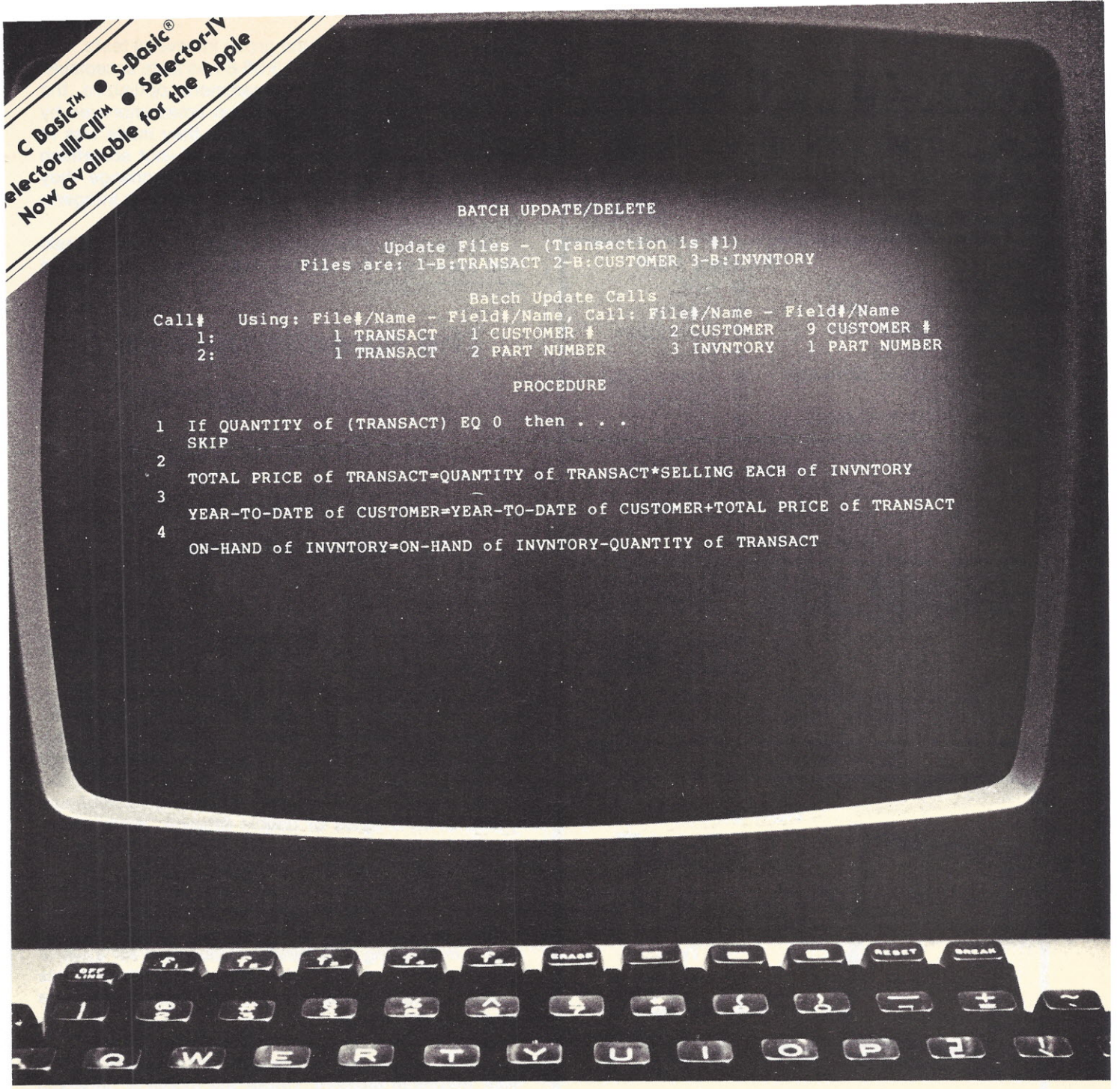
**Program optimized by Radio Shack ran in 2:59.3

by Hillel Segal

Among the variety of TRS-80 computers, the model II is Radio Shack's offering best-suited to serious business applications. With its 8-in. floppies and full 64K bytes of memory capacity, plus the availability of CP/M operating systems for outside sources, the model II is a respectable entrant in the field.

The Association of Computer Users benchmark tests were run on a configuration of the model II with a CRT and detached keyboard, three floppy disk drives, and 64K bytes of memory. A 120 character-per-second dot matrix character printer called the Line Printer III is being phased out in favor of the 160 cps Line Printer V, which also features scientific characters. Equipped with the standard TRSDOS operating system and Microsoft Basic, the system we tested now lists at $7,609 from Radio Shack dealers.

And the test results? They were not earth-shattering, but the system proved to be no slouch. It was almost



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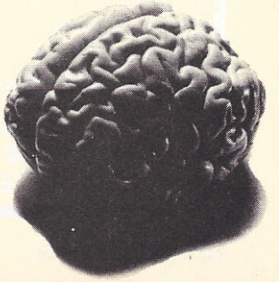

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exactly in the middle of the group in several tests. The accounts receivable time of 3:36.8 was quite acceptable.

When Radio Shack programmers optimized the standard benchmark program, run times improved by up to one-third. One major change they made was to defeat the read-after-write safeguard—not something you'd want to do in practice. Another change they made was to declare many of the variables as integers, thus speeding up math execution.

We used the standard, interpreted version of Basic that comes with the system. Radio Shack also offers a Compiler Basic, which the company states runs up to three times as fast.

The recently-upgraded operating system has several extras for efficiency and ease of use.

The storage system of the model II is one feature that sets it apart immediately from the model III. Equipped with one 8-in. floppy, up to three additional drives can be added externally. The total storage available to the user is then 1.874M bytes. With the model III and its 5¼-in. floppies, the four-drive maximum yields 670.7K bytes of usable storage. While either could be a limitation on the size of the application, the model II has nearly three times the capacity.

Hard disk storage is not presently offered but company representatives hint it may be offered soon.

One quirk of the model II storage system may be worth mentioning: the minimum allocation for a file is five sectors, or 1,280 bytes. Files not containing this much code will thus be stored inefficiently, wasting up to 1K of disk space.

Standard memory supplied with the model II is 32K; however, most applications software requires the full 64K maximum memory. Unlike the model III, in which Basic is stored in a ROM area that takes up 16K bytes, the model II keeps its languages and operating system on disk, bringing them into RAM when used.

Other notable features of the system include a 24 by 80 character display, detachable keyboard with numeric keypad and two RS-232 interfaces for use with modems, plotters, etc.

The model II's recently-upgraded operating system has several extras that make a contribution to efficiency and ease of use. Spooling capability allows background printing, and up to 80 keyaheads are allowed (commands entered while the previous commands are still being executed).

TRSDOS syntax is explained through a HELP command, and error messages (identified by number) can be explained in detail by the system on request. Some 37 commands and several utilities are available to the user.

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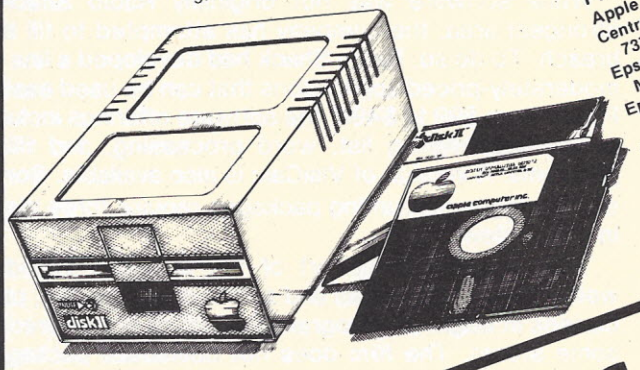

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One drawback noted by users was an apparent lack of safeguards against blowing a disk by inadvertently turning off the system or diskette power switch during operation. These switches were perhaps placed too easily within reach of naive or careless users. The solution: frequent use of the BACKUP program and more attention to operational procedures.

Outside sources have made available several versions of CP/M for use with the TRS-80 model II. This system greatly expands the number of languages and programs that can be used with the computer. (Radio Shack offers Cobol, Fortran, Assembler and a Basic compiler.)

The standard Basic interpreter that comes with the system includes features of interest to both beginning and experienced programmers. These consist of line renumbering, immediate mode of execution, automatic recovery from operator command error (such as routing output to a printer that's turned off), assembly language subroutine calls, and use of operating system commands within programs.

Some limitations in editing

The Basic line editor, while easy to use, had one annoying drawback: after each line, the EDIT command must be typed again to continue—requiring some extra time and effort. A more sophisticated editor is available as an option.

While software was not originally Radio Shack's strongest area, the company has attempted to fill the breach. To do so, Radio Shack had developed a line of moderately-priced applications that can be used easily. Priced from $99 to $499, the software offerings include accounting, mailing list, word processing, and filing programs. A version of VisiCalc is also available. Some of the bigger accounting packages require three disks in the system.

The company's support of the software includes well-referenced manuals and self-teaching guides, plus classes in beginning programming which are offered at some stores. The firm does not customize packages for its customers or provide detailed installation and training support.

Our survey of users indicated few complaints with hardware service. Where users encountered initial hardware difficulties with their systems, the problems were solved under the warranty program. Service contracts are also offered for long-term support.

Rather than asking the businessman to become a programmer/hobbyist, Radio Shack has come to the businessman with a usable set of software and a hardware system that offers solid performance at an excellent price. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several foreign countries.

One of the association's key activities is the publication of its Benchmark Reports. Each month a new report is produced covering a computer system.

In addition, ACU publishes seven bimonthly newsletters for users of small computers, midi computers, large computers, time-sharing systems, distributed processing systems, word processing systems and home and hobbyist computers.

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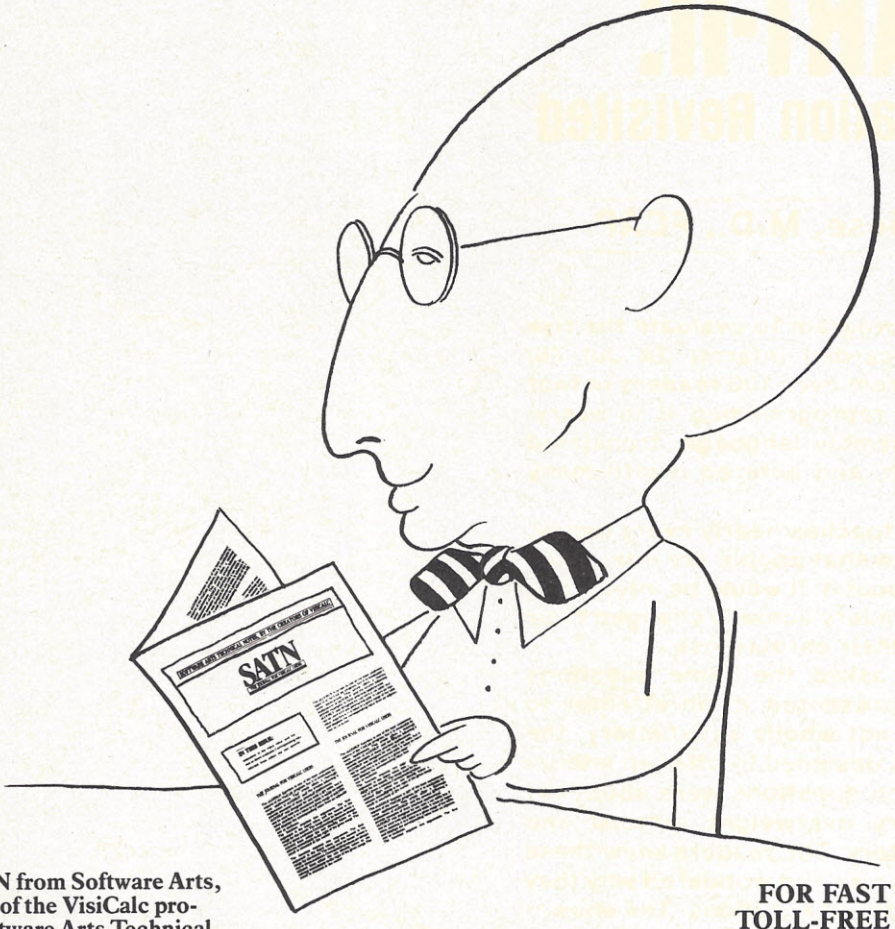

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HEART-II:
Risk Evaluation Revisited

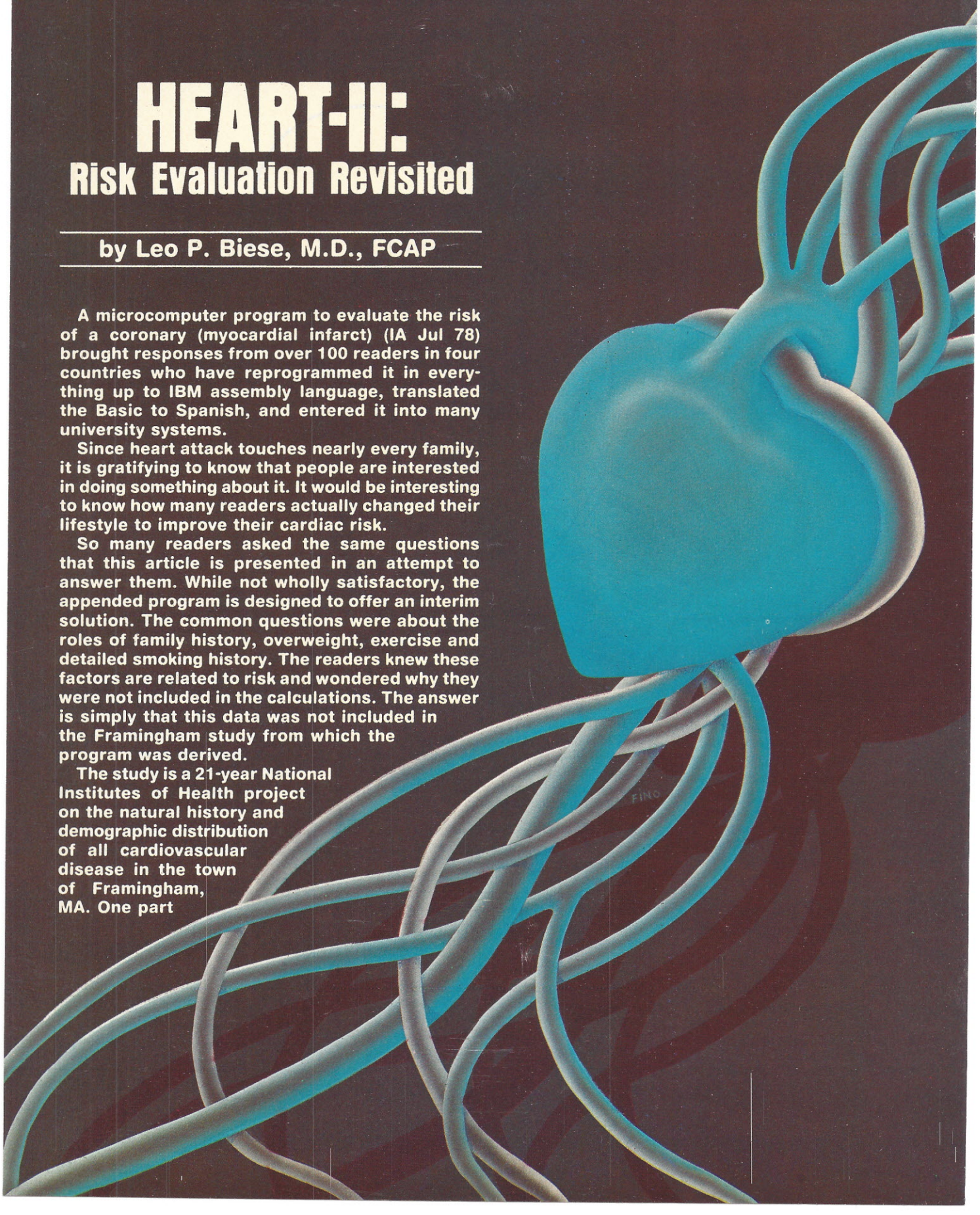
by Leo P. Biese, M.D., FCAP

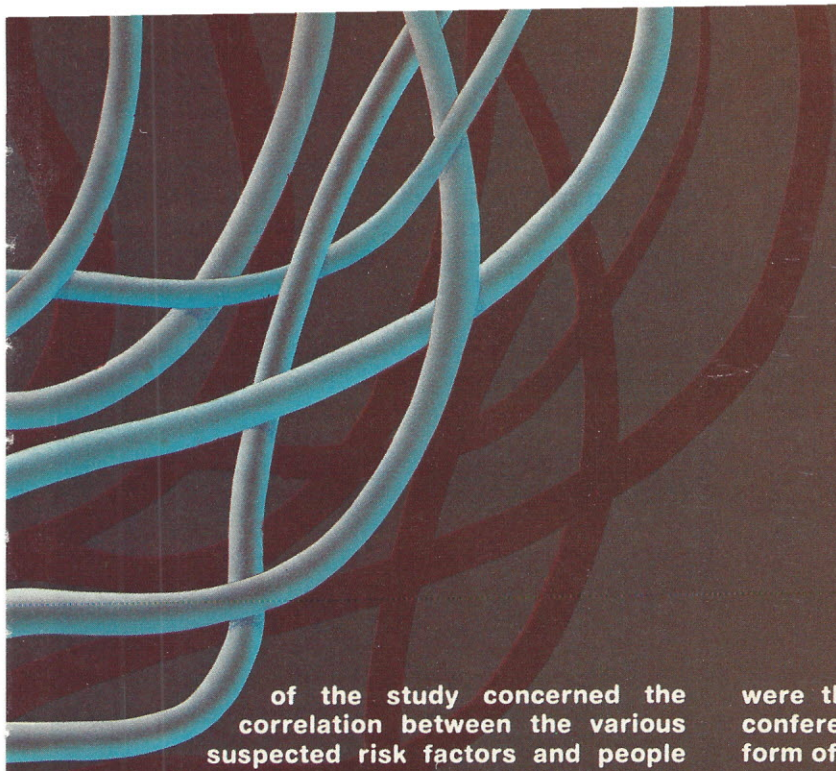
A microcomputer program to evaluate the risk of a coronary (myocardial infarct) (IA Jul 78) brought responses from over 100 readers in four countries who have reprogrammed it in everything up to IBM assembly language, translated the Basic to Spanish, and entered it into many university systems.

Since heart attack touches nearly every family, it is gratifying to know that people are interested in doing something about it. It would be interesting to know how many readers actually changed their lifestyle to improve their cardiac risk.

So many readers asked the same questions that this article is presented in an attempt to answer them. While not wholly satisfactory, the appended program is designed to offer an interim solution. The common questions were about the roles of family history, overweight, exercise and detailed smoking history. The readers knew these factors are related to risk and wondered why they were not included in the calculations. The answer is simply that this data was not included in the Framingham study from which the program was derived.

The study is a 21-year National Institutes of Health project on the natural history and demographic distribution of all cardiovascular disease in the town of Framingham, MA. One part





of the study concerned the correlation between the various suspected risk factors and people who actually went on to suffer a heart attack during the study period. Unfortunately, because of the state of our knowledge when the study program was set up, the other factors were not included.

Since that time there have been many similar studies addressing this problem; most notable are the retrospective studies based on insurance company records, coupled with a large number of critical literature reviews and interdisciplinary seminars. The program presented here is based on data from this source.

One will immediately be tempted simply to add these new risk factors to the existing program, but the reader is cautioned that they are derived from a different population group, and a proper statistician would immediately question the validity of any resulting risk factors—and quite rightly so. The present data are, for example, based on risk for the ensuing ten years, while the Framingham data are based on a six-year projection.

While a combined program would not be valid from an actuarial point of view, the populations should be similar enough to make the results valid for the purpose intended: to show the decreased risk that can be enjoyed by lowering the correctable risk factors.

The numbers used in the risk analysis are based on statistics developed in 1974 by the National Center for Health Statistics (Dr. Geller). The facts were then refined through a large number of conferences (Dr. Gesner) and presented in the form of Geller-Gesner Tables in the book by Jack H. Hall and Jack D. Zwemer, *Prospective-Medicine*, Methodist Hospital of Indiana (1979). The definitions that follow are paraphrased from that source.

The risk factor for a particular prognostic indicator is the "odds ratio" for the event $[P/(1-P)]/[P''/(1-P')]$ where P = people with the assumed risk and P' = all members of the same age/race/sex group.

or:

$$\text{Risk factor} = \frac{\text{Specific disease mortality among those having the risk factor}}{\text{Disease mortality among all those in one group}}$$

A composite risk factor is an expression of risk in an individual for a particular cause of death when all prognostic characters are considered. The model for the calculations depends on the relationships assumed to exist among the risk factors and their interaction with each other. Because of its widespread acceptance by actuaries, a Credit-and-Debit model is employed for a composite risk.

In this model, the combined effect of several prognosis characteristics is represented by adding in some cases and multiplying in others. Risk factors greater than one are combined by

addition, while risk factors of less than one are multiplied. The combined credit is then used in determining the composite risk factor. While more mathematically sophisticated models have been proposed, they do not reflect actual experience any more accurately.

The Prospective Medicine Handbook contains data for the ten leading causes of death according to age, sex and race. The tables are in the process of being programmed for the microcomputer for an overall Health Risk Appraisal, but only the data for heart attack is used in the present program.

A sample of the published data for males has been extracted and rearranged in table 1, and for females in table 2, so that you may cross check the data state-

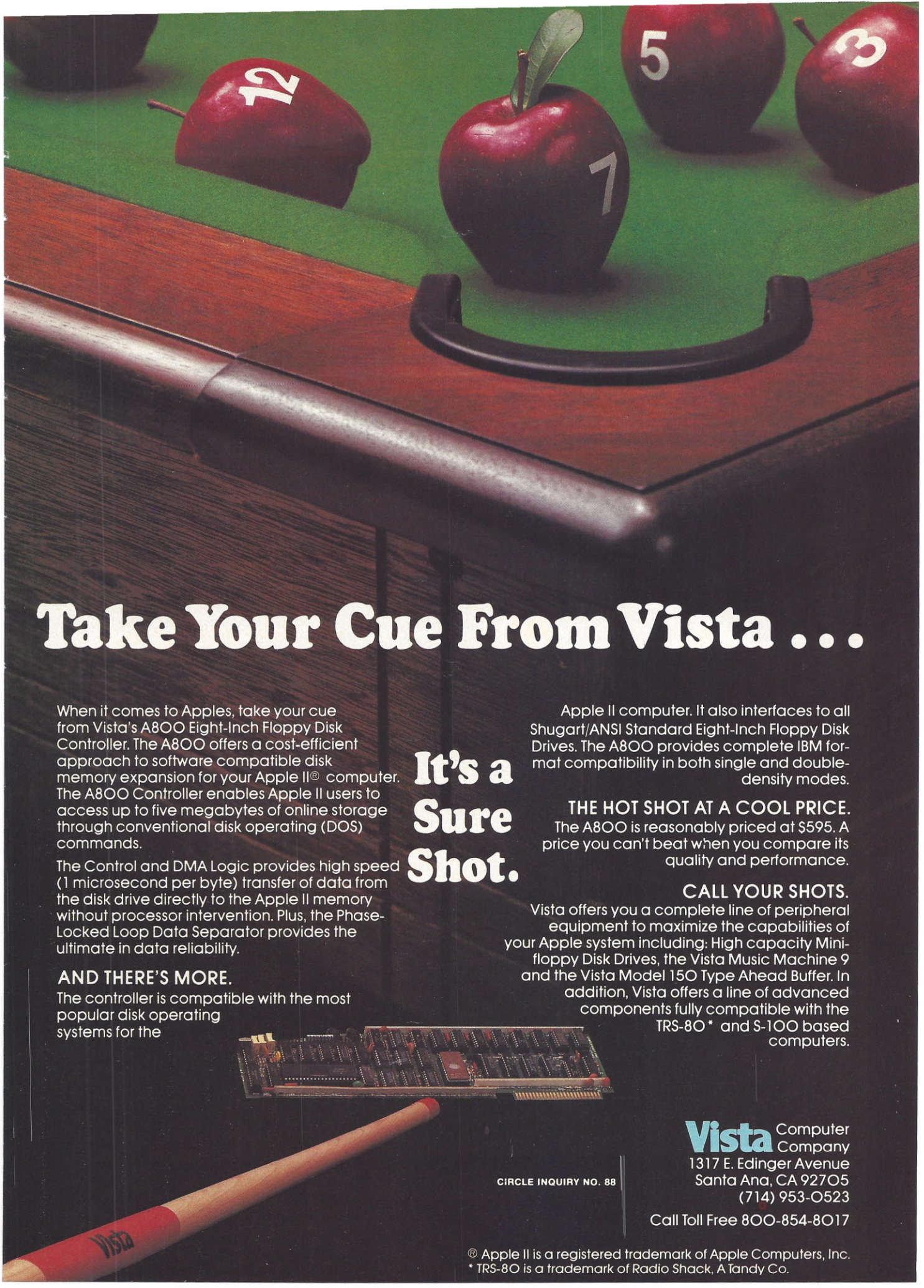
Table 1. Geller-Gesner tables for males: Risk of Myocardial Infarction

	start of five-year age group									
	25	30	35	40	45	50	55	60	65	70
EXERCISE										
sedentary	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.6	1.6
some	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3
moderate	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
vigerous	1.0	0.9	0.9	0.9	.0.8	0.8	0.7	0.7	0.7	0.7
FAMILY										
none > 70	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1
both > 70	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8
SMOKING now										
40 +/day	3.0	2.7	2.4	2.2	2.0	1.8	1.6	1.4	1.3	1.2
20-39/day	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.2
10-19/day	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2
<10/day	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0
20/day, quit										
1 year ago	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
1-4 years	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9
5 + years	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.7	0.8
>20/day,quit										
1 year ago	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	1.0
1-4 years	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
5 + years	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9
NEVER SMOKED	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6	0.7	0.8
WEIGHT										
+ 60%	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.6
+ 50%	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.4
+ 20%	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
average	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
- 10%	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7

Mortality/100,000 population										
	White									
cardiac	62	214	601	1355	2567	4248	6694	9859	13910	19429
all causes	1643	1901	2752	4423	7203	11203	17306	25227	35403	49057
	Black									
cardiac	133	376	902	1728	2980	4670	7008	8997	12175	16741
all causes	3911	4773	6552	9051	12780	17923	24780	30202	39614	52798

* Rearranged from the data in: Hall, Jack H. and J.D. Zwemer; Prospective Medicine, Methodist Hospital of Indiana (1979)

Continued on page 146



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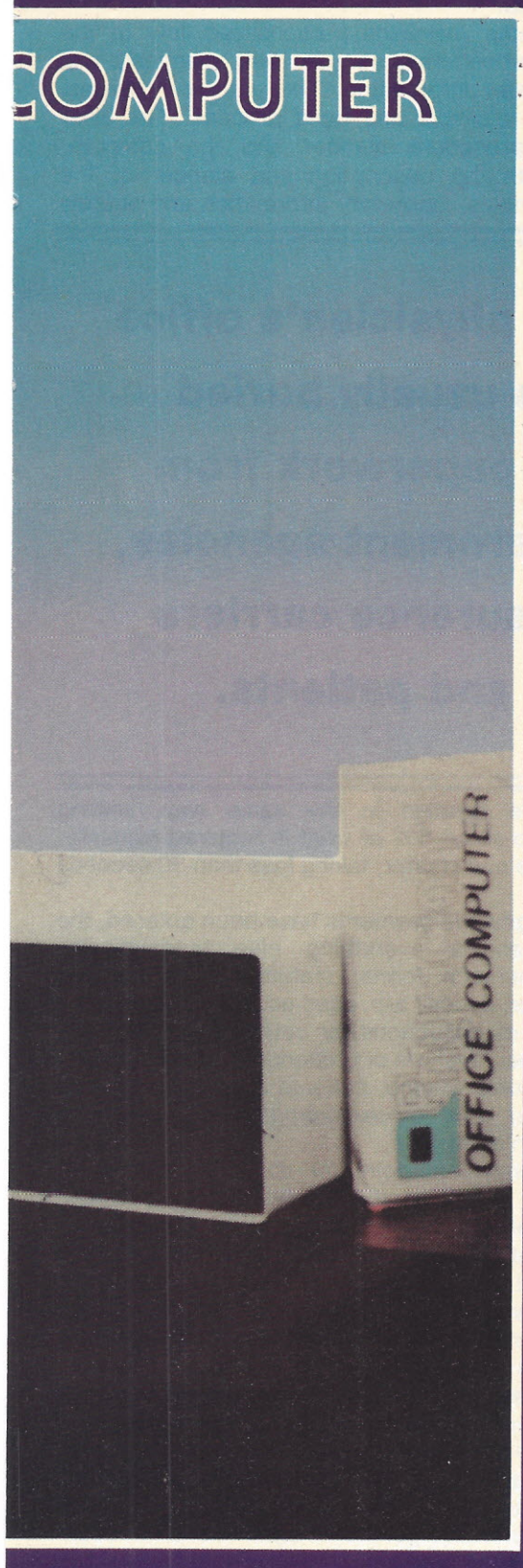

by John Ashton, M.D.,
David M. Brickman, M.D., and Jeff Balsam
Professional Systems Corp.
3858 Carson St., Suite 220
Torrance, CA 90503

The desktop computer can provide a powerful range of useful capabilities in streamlining the operations of a medical office. Computers found their first medical applications in the areas of administration and billing for hospitals. This was a natural extension of their established role in business and accounting. Today medical office computers are entering the private physician's office exactly the same way. These systems are so cost-effective they can actually pay for themselves within the first six months by increased collections, reductions in errors and substantial savings in staff time.

A medical office computer may be purchased for a specific function such as financial management. Programs may be added in the future to perform many additional tasks such as clinical record-keeping, word processing, accounting, inventory control, and even non-medical applications. The same system may be used to communicate via telephone to large national data bases for everything from medical education and research to stock market quotations.

The physician's office is usually buried in paperwork because of the requirements of government agencies and insurance carriers, as well as the needs of patients. In the past, this paperwork has been generated manually using clerical personnel who spent the entire day repetitively copying ledgers, typing insurance forms and stuffing envelopes. Frequently, the staff fell far behind in patient billing.

Instead of one or more persons devoted exclusively to such tasks, the computer comfortably handles these functions in a fraction of the time with fewer errors. The average office can expect substantial time savings over manual methods. Besides the time saved, nearly 90% of practices report a significant increase in collections, as well as greatly improved collection times.

Although each system has its unique approach, the medical office computer generally handles patient financial management as follows:

On the first visit to the office, an information form is filled out. The form has the patient's name, address, head of family, insurance companies, phone, responsible party, etc. This is the same form that has always been used on the patient's initial visit to the doctor.

This new patient information form is given to the biller who enters the information into the system. Entering a new patient takes about a minute. Once on the computer, the patient information stays there. If the patient's demographic information changes, the computer ledger may be updated in a few seconds.

The most important benefit here is that the computer maintains the patient's ledger and all associated financial information. Manual entry, handling and filing of this information is unnecessary when you use an in-house computer. Once on the system, it takes only a

The Medical Office Computer Shopper's Checklist

1. How easy-to-use is the system?
2. How many systems are currently in the field?
3. How long has the company been in business?
4. Will they provide names of current users? (If not forget about them. Be sure to check out the referrals. They will tell you a lot more than the salesman.)
5. Will they train your office staff as much as necessary and how much after-sale support will they guarantee?
6. How much training will be necessary before the system may be operated by your staff and is this training included in the cost of the system?
7. Can you understand what the salesperson is showing you? (If not, the office staff will probably have even more trouble.)
8. Can you enter your own data into the system and see the reports, or are you only seeing a pre-arranged demonstration?
9. Will they provide on-site maintenance and what is the cost?
10. What about software updates? (Every system needs occasional changes.)
11. Do they offer one-stop service or will you have to deal with two, three or more vendors to maintain the computer? (With more than one vendor, it is possible no one will accept responsibility for the problem.)
12. How thorough and well written is the user's manual?
13. What enhancements are currently in the works?
14. What are each of the reports the computer supplies?
15. How are you protected in case of power failure or system malfunction?
16. Are hard-copy print-outs readily available for all transactions and other valuable information?
17. Who makes the hardware and how reliable is it? (Check with current users about this.)
18. How many patients will the system handle?
19. How many doctors will the system handle?
20. How many transactions will the system handle daily?
21. How many patients may be maintained with complete ledgers for a year?
22. Does the system maintain a permanent record of all patients, or are they removed every time their balance is 0?
23. How well supported is the system by other hardware and software vendors?
24. Is it a hard disk or floppy system?
25. Can the system be easily and cost-effectively expanded and/or upgraded?

matter of moments to call up a patient's ledger for viewing on the screen or printing.

When the physician sees the patient, the charges are checked on a fee slip. These charges are entered into the system at the rate of approximately 30 to 45 seconds per patient, depending upon the number of transactions.

The computer maintains personalized lists of the physician's procedures, service fees, diagnosis and other necessary information. The entry of charges, therefore, is a simple and rapid process. The biller enters the procedure number and the computer responds with the description and amount of the charge. Diagnosis, laboratory information and outside

The physician's office is usually buried in paperwork from government agencies, insurance carriers and patients.

providers are handled in the same way, limiting keystrokes to about 5% of what is required manually. Payments are even faster, taking less than 30 seconds per patient.

After charges and payments have been entered, the computer handles everything else automatically, including insurance forms, statements, day sheet, check register, deposit slip, aged-accounts receivables, breakdowns of collections by category for the day, month and year, analysis of procedures performed with associated dollar volume, patients seen, alphabetized patient list(s), and cross-posting reports between doctors when applicable.

At any convenient point (or daily), the computer automatically prints all the insurance forms without additional work on the part of the biller. These forms are printed at the rate of about four per minute. The computer will print two insurance forms automatically if there are two policies. The system will also print additional forms whenever there are more charges than a single form can handle.

On demand, the system automatically produces patient statements for all patients with outstanding charges who are designated to be billed. The statements contain aging information with appropriate messages under the control of the office.

The computer also generates aged-accounts receivables, delinquency reports, as well as a day sheet and detailed financial reports for each physician. All of these reports are produced with much greater speed

Continued on page 150

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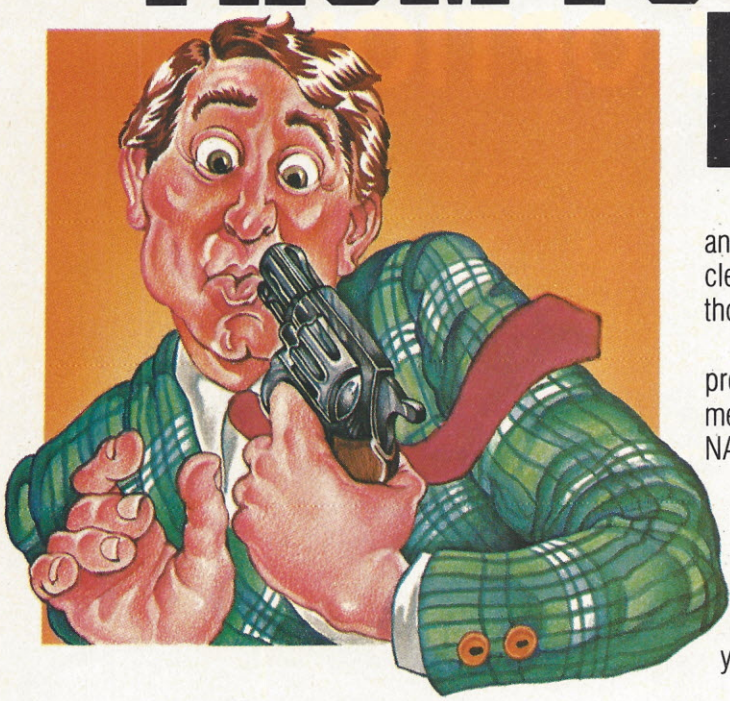

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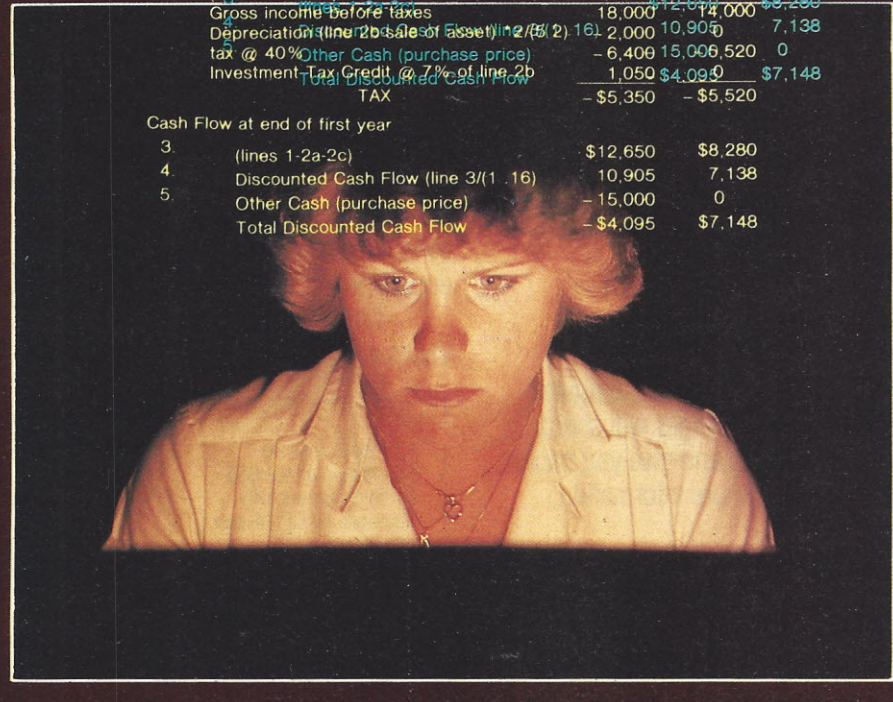
PROGRAMMING EQUIPMENT PURCHASE OPTIONS

First Year

ITEM	DESCRIPTION	BUY	LEASE
1.	Cash Inflows (revenues)	$20,000	$20,000
2.	Cash Outflows		
	a. Maintenance + supplies + lease cost	– 2,000	– 6,200
	b. Purchase Price	– 15,000	0
	c. Taxes	– 5,350	– 5,520
	(tax calculation)		
	Gross income before taxes	18,000	14,000
	Depreciation (line 2b-sale of asset) *2/(5 2)	– 2,000	0
	tax @ 40%	– 6,400	– 5,520
	Investment Tax Credit @ 7% of line 2b	1,050	0
	TAX	– $5,350	– $5,520
Cash Flow at end of first year			
3.	(lines 1-2a-2c)	$12,650	$8,280
4.	Discounted Cash Flow (line 3/(1 .16)	10,905	7,138
5.	Other Cash (purchase price)	– 15,000	0
	Total Discounted Cash Flow	– $4,095	$7,148


First Year

ITEM	DESCRIPTION	BUY	LEASE
1.	Cash Inflows (revenues)	$20,000	$20,000
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	b. Purchase Price	– 15,000	0
	c. Taxes	– 5,350	– 5,520
	(tax calculation)		
	Gross income before taxes	18,000	14,000
	Depreciation (line 2b-sale of asset) *2/(5 2)	– 2,000	0
	tax @ 40%	– 6,400	– 5,520
	Investment Tax Credit @ 7% of line 2b	1,050	0
	TAX	– $5,350	– $5,520
Cash Flow at end of first year			
3.	(lines 1-2a-2c)	$12,650	$8,280
4.	Discounted Cash Flow (line 3/(1 .16)	10,905	7,138
5.	Other Cash (purchase price)	– 15,000	0
	Total Discounted Cash Flow	– $4,095	$7,148

by Keith P. Graham

The buy-lease decision in computer acquisition is often overlooked but is never unimportant. The decisions that the prospective buyer of a small system must make seem endless. The combinations of available hardware and software are virtually infinite. Acquiring a computer means doing your homework, and deciding on how to finance the acquisition should not be left to the last minute.

Basically, there are two alternative methods of financing. Each has its advantages and drawbacks. Attaching a dollar value to every factor involved and putting the factor on the correct side of the scales can be confusing and difficult.

The first method, purchasing, is the most common. The major cost of purchasing is the interest paid on the money borrowed from the bank, or the interest lost when the cash is removed from the savings or other investments. The advantage to purchasing is that the I.R.S., in some cases, will allow investment tax credit and accelerated depreciation. These two factors can soften the blow of the interest cost of purchasing.

Leasing, on the other hand, may not call for an initial outlay of cash. This can be a distinct advantage when other sources of capital are tight or expensive. Remember, however, the leasing company has to borrow the money and is passing the cost on to you. Of course, the leasing company may take advantage of investment tax credit and accelerated depreciation, options which may no longer be available to you. (Some leases allow the leasee to take investment tax credit. This should be taken into account in the analysis.)

The Net Present Value method for evaluating the factors in the buy-lease decision is a widely accepted method, being preferred in many accounting and finance textbooks. The main advantage of this method is that it takes into account the time value of money: a dollar today is worth perhaps $1.11 tomorrow, not from inflation, but by its earning capacity. Similarly, the same dollar today was worth $.90 yesterday because it has been working since then, and only $.90 had to be invested yesterday to give us a dollar today.

In short, money varies in value in the course of time. In times when interest rates are higher, the increase of the value of money in time is higher. Any analysis that involves the commitment of cash for a period of years must include the time value.

Other methods of analysis can place a time value on money. Break Even analysis is an example. Discounted Cash Flow has the added advantage of placing a total cost on each alternative (no matter how theoretical) and, therefore, is a more satisfying method to many who would like to know, in dollars and cents, the costs of various alternatives.

To see how Discounted Cash Flow works, take the following example: A friend of yours, the owner of a small but growing business, has decided on acquiring a small computer. The purchase price is $15,000, which you can expect to sell for $5,000. The five year lease cost is $4,200 per year. Other costs are maintenance and supplies, which run about $2,000 per year. The depreciation method is double the declining balance, and the purchase would be eligible for a 7% investment tax credit. Your friend's tax rate is about 40%, while his current bank interest rate is about 16%. The justification for acquiring the computer is that it should save your friend about $20,000 per year in labor and lost business. What do you do with all these numbers?

The logical answer is to perform the analysis on a computer. The following program was written using the IBM 5120 computer system and operates in about 8K. The program is fairly simple and should transport simply to any system using Basic. My own aim in writing the program was not to produce a complete functional analysis tool, but to outline the steps that such a tool would require. The program listed is a skeleton, waiting to be modified to fit your application.

Basically, the program has three parts, data entry, report lines, and summary. The report line is relatively complicated, with a few threads of spaghetti weaving through depreciation and tax computations. Overall, the present structure is receptive to any alterations or improvements you might like to make. One that comes to mind is a fourth type of depreciation method. The I.R.S. allows a depreciation rate that is either straight-line, double declining balance or sum of years digits, whichever gives the greatest rate. It is tricky to calculate and probably not necessary for this relatively simple approach.

The program starts off with a series of comments that are good for documentation, but are not necessary for operation. Those with limited RAM will not bother to enter them. The next step is to read the Alpha descriptions of the data that have been stacked in the data statement lines 1010 to 1030. This is done with the FOR/NEXT loop from lines 1100 to 1160.

After each data item is read, it is also displayed with the request ENTER DATA. By the time execution reaches line 1200, A$ has 11 Alpha descriptions and A has 11 inputted data items.

Since calculations are made on a year-by-year basis, all cost must be annualized. $100 per month is entered as $1,200. Interest rate, tax bracket and investment tax credit rate are entered as percentages. 12% is entered as 12, and not as 0.12. The three choices of depreciation method are: 1) straight line; 2) sum of the year's digits; and 3) double declining balance. Any other number will give straight line.

Sale of the old asset is the price that any replaced asset was sold for. An option might be that the old asset is kept and used so you might put a 0. Sale of the new asset is the value of the

		First Year	
ITEM	DESCRIPTION	BUY	LEASE
1.	Cash Inflows (revenues)	$20,000	$20,000
2.	Cash Outflows		
	a. Maintenance + supplies + lease cost	-2,000	-6,200
	b. Purchase Price	-15,000	0
	c. Taxes	-5,350	-5,520
	(tax calculation)		
	Gross income before taxes	18,000	14,000
	Depreciation (line 2b-sale of asset) *2/(5 2)	-2,000	0
	tax @ 40%	-6,400	-5,520
	Investment Tax Credit @ 7% of line 2b	1,050	0
	TAX	-$5,350	-$5,520
Cash Flow at end of first year			
3.	(lines 1-2a-2c)	$12,650	$8,280
4.	Discounted Cash Flow (line 3/(1 .16)	10,905	7,138
5.	Other Cash (purchase price)	-15,000	0
	Total Discounted Cash Flow	-$4,095	$7,148

Figure 1. Example of discounted cash flow

purchased asset at the end of its life. Lines 1200 and 1240 display the contents of A$ and A for the operator to check. A prompt is made at line 1300. If the operator enters 0, the program begins its analysis. If the operator enters a number from 1 to 11, the program requests a new value for the corresponding data item and then loops back to 1200.

The main advantage to this approach to data entry and verification is that it does not rely on the peculiarities of any machine. There are no tabs or print @ type of statements. One of the advantages of using Basic is its ability to format the print zones. Basic will do much of the work for you if you let it.

Lines 2100 to 2220 print the titles. Those with limited machines may want to use a more austere heading to the report. For those who would like to produce a document from this program, the heading should include the values of all 11 variables, as well as the name of the company for whom this analysis is performed.

Terminal displays output

This program displays its output at the terminal, but the print statements could easily be changed to PRINTL, PRINT FLP, LPRINT, or whatever command your Basic uses to produce hard copy. (Delete line 4900. If you use a printer, it is not necessary to pause after every page.) Line 3000 begins the report line section. This section is a loop from 3050 to 5000. It loops once for each year. 3110 prints the cash inflows and line 3120 prints the lease expense and maintenance cost. Line 3230 calculates straight line depreciation, 3310 calculates sum of year's digits, and 3410 calculates double the declining balance. In the first year the depreciation is only half because, on the average, a taxpayer only takes half year of depreciation.

Line 3690 prints the cost of the asset and 3700 prints the sale of the asset being replaced. Line 3810 calculates the last year's depreciation, which is simply any depreciation left at the end of the cycle. Line 3820 prints the sale of the new asset at the end of the period of analysis. This is necessary even if you plan to keep the asset. Under the terms of the lease, the leaser retains title to the asset. After the lease period is over, you don't own the asset. This may be an advantage of purchasing over leasing, and we have to show the asset's value as a plus in the buy column after the period of the lease.

After all the year's cash flows are added up, lines 4000 to 4020 calculate the income tax. After the tax is printed, the yearly income (or loss) can be printed. Lines 4100-4130 check the interest rate for validity and arbitrarily substitute 15, if the rate does not seem reasonable.

The Net Present Value calculation uses a FOR/NEXT loop rather than exponentation. Once the Net Present Value is calculated, it can be printed, grand totals accumulate, and the process starts for the next year.

After printing the grand totals, the program makes a decision. If the difference between alternatives is less than 10% of the average Net Present Value of the cash flows, the computer won't decide. This is a reasonable thing to do. After all, this program is only as good as the data that is put in it. You can't hope to consider all factors with a short program. There are many financial and non-financial factors to the buy or lease decision. If the decision leans more than 10% one way or the other, you might seriously consider the computer's advice. What is probably being indicated in this case is that the lease cost is high, or that your own interest rates differ from the leasors. What also happens is that the leasor is eligible for investment tax credit when you are not. He can pass on that savings to you.

Finally you have the choice of whether or not to start over again. Line 7100 asks the operator if he would like to perform another analysis. If Y$ = 'Y', back you go to start over.

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A Case History
By
Paul Franson
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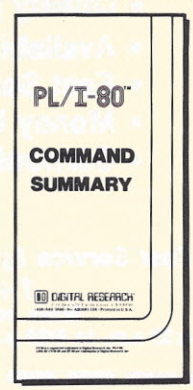

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There is a mistaken tendency to put a lot of faith in an analysis such as this. The computer is only giving back to you what you put into it. The program cannot take into account all factors. Suppose the computer tells you that buying is the best alternative, but you don't have the cash. This doesn't mean don't lease. Leasing is obviously the best alternative because the only other choice is doing without.

```
****BUY OR LEASE DECISION ANALYSIS****
          NET PRESENT VALUE METHOD

**********************************************
 YEAR                          BUY      LEASE
==============================================
 1     CASH INFLOWS           20000     20000
       LEASE + MAINT.         -2000     -6200
       COST OF ASSET         -15000
       SALE OF OLD ASSET          0         0
       TAX ON SALE                0         0
       INCOME TAX             -5350     -5520

       CASH FLOW              -2350      8280
       NET PRESENT VAL        -4095      7138

 2     CASH INFLOWS           20000     20000
       LEASE + MAINT.         -2000     -6200
       INCOME TAX             -5920     -5520

       CASH FLOW              12080      8280
       NET PRESENT VAL         8977      6153

 3     CASH INFLOWS           20000     20000
       LEASE + MAINT.         -2000     -6200
       INCOME TAX             -6432     -5520

       CASH FLOW              11568      8280
       NET PRESENT VAL         7411      5305

 4     CASH INFLOWS           20000     20000
       LEASE + MAINT.         -2000     -6200
       INCOME TAX             -6739     -5520

       CASH FLOW              11261      8280
       NET PRESENT VAL         6219      4573

 5     CASH INFLOWS           20000     20000
       LEASE + MAINT.         -2000     -6200
       SALE NEW ASSET          5000
       INCOME TAX             -6509     -5520

       CASH FLOW              16491      8280
       NET PRESENT VAL         7852      3942


GRAND TOTALS                  26364     27111
```

Figure 2. Sample printout of analysis

One of the shortcomings of the program is that it uses bank interest as the discount percentage. There are arguments pro and con on this matter. Bank interest isn't the true cost of money; it is merely a very convenient indication that probably isn't too far wrong. At best, the results of this program are one of many useful tools that you can use to make a complicated decision a bit simpler. □

Program on page 152

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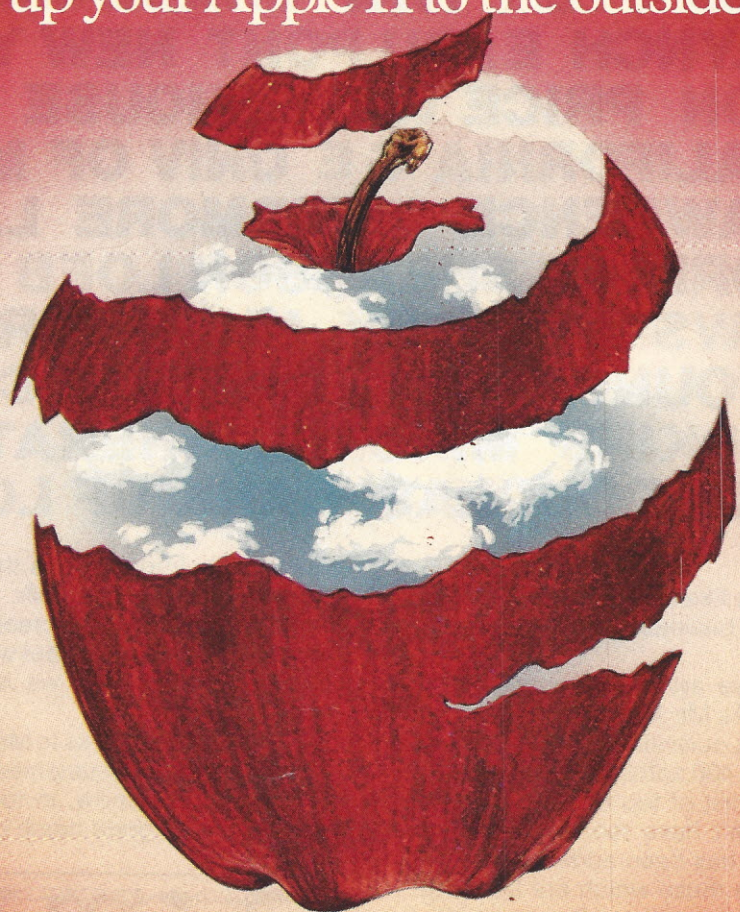

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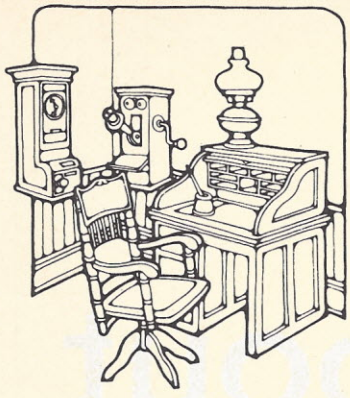

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About Sorts— Part II

by Gene Cotton

In the first part of this investigation (IA Aug 81), five methods of sorting were considered. The first four suffer from the same problem. They are very slow when applied to lists in random order. The Insert Sort is considered the best if the original list is in relatively good order. The remaining methods will be most useful on the random ordered lists. All of the previous methods are based on Method One. Any further improvement must come from entirely new concepts.

The sixth sort method is called Heapsort. Another approach to the ordering problem was developed. The essential part of the first three methods had been perceived as follows: the largest element is selected and placed in the last position of the list. The last element is swapped with the largest element and the effective size of the list is reduced by one. The largest element in the list is located by comparing successive elements in the list, retaining the address of the larger element.

Suppose that the largest element in a list is at the top of the list. Then that element could be swapped with the last element in the list and the effective length of the list could be reduced by one element. If the largest element in this new, shorter list can easily be forced to the top of the list, it too could be swapped with the new end of the list and the length of the list is again

shortened. If the process can be repeated long enough, the effective length of the list will be reduced to one element and that element would be properly placed.

Looking at each element in the list to determine the largest will require (N – 1) (N – 2) (N – 3) ...2 = (N – 1)N/2 or approximately $N^2/2$ compares. This is no better than method two.

If it were possible to determine the largest element without looking at each of the remaining elements every time, the number of compares could be reduced.

This would be possible if the original list were composed of three sublists with the properties that the first sublist consists of a single element at list location 1; and that the first element in the sublists two and three is the largest element of the sublist. This is accomplished by comparing the single element in the first sublist with the larger of the two top elements of sublists two and three, and possibly swapping to insure that the largest element is now the single element at the top of the list.

Different elements compared

If the task is restricted to three elements at arbitrary positions in the list, the task is simplified. The second element is compared to the third element. The larger of these two elements is then compared to the first element. This produces the largest element of the three. To maintain the first element as the largest, simply swap the first with the larger of the second and third if necessary.

Suppose the list is originally ordered such that the first element of the list is larger than the second or third. The second element is larger than the fourth and fifth elements. The third element is larger than the sixth or seventh elements. In general, any element is larger than the element which is twice as far down the list and the element adjacent to that element. This is expressed by the quasi-Basic statements:

A(I) > A(2*I) and A(I) > A((2*I) + 1)

Now form the three sublists from the stated elements:

1. The element at position 1.
2. The elements at positions 2, 4, 5, 8, 9, 10, 11, 16, ...
3. The elements at positions 3, 6, 7, 12, 13, 14, 15, 24, ...

These sublists are formed from the root element at 1 and the two branches of the upside down tree:

```
                    1

          2                   3

     4         5         6         7

  8    9   10   11   12   13   14   15

16 17 18 19 20 21 22 23  24 25 26 27 28 29 30 31
```

The first problem is getting the original list to fit this requirement. This is accomplished by proceeding backwards from the end of the table and considering each subset of three elements, (15, 30, 31), (14, 28, 29), ... (1, 2, 3). At each subset, ensure that the first element of each trio is the largest of the three. The Basic routine applied to a single trio would be:

```
220 REM TRIO COMPARE ASSUMES THAT R0
      CONTAINS 1ST ELEMENT
230 REM 2ND & 3RD ELEMENTS ARE CALCULATED
250 R1 = R0 + R0
280 IF A(R1) ⩾ A(R1 + 1) THEN 300
290 R1 = R1 + 1
300 IF A(R0) ⩾ A(R1) THEN 360
310 T = A(R0)
320 A(R0) = A(R1)
330 A(R1) = T
360
```

If element 7 is swapped with element 14, element 14 may not be larger than 28 or 29. This means that whenever a swap occurs, that branch of the tree must be checked to maintain the proper organization. It may be necessary to force an element down the layers of branches until it reaches the bottom of the "heap." With this correction the routine becomes:

```
220 REM TRIO COMPARE ASSUMES THAT R0
      CONTAINS 1ST ELEMENT
230 REM 2ND & 3RD ELEMENTS ARE CALCULATED
240 REM CHASE A SWAPPED ELEMENT TO THE
      BOTTOM OF HEAP
250 R1 = R0 + R0
260 IF R1 > N THEN 360
270 IF R1 = N THEN 300
280 IF A(R1) ⩾ A(R1 + 1) THEN 300
290 R1 = R1 + 1
300 IF A(R0) ⩾ A(R1) THEN 360
310 T = A(R0)
320 A(R0) = A(R1)
330 A(R1) = T
340 R0 = R1
350 GOTO 250
360
```

It is useful to notice that no more than four layers must be checked if the number of elements is 31. In general, the number of layers to be checked is not more than that power of 2 just bigger than the list size. If the list size is N, the maximum number of layers to be checked is K, where $2^{K-1} < N < 2^K$.

Also notice that a choice of R0 greater than half the list size will be fruitless, since a trio of elements cannot be formed. The manipulation should begin with R0 set at half the table size. The entire process of bringing the list into the needed original order becomes:

```
200 FOR I = INT(N/2) TO 1 STEP – 1
210 R0 = I
220 REM TRIO COMPARE ASSUMES THAT R0
      CONTAINS 1ST ELEMENT
230 REM 2ND & 3RD ELEMENTS ARE CALCULATED
240 REM CHASE A SWAPPED ELEMENT TO THE
      BOTTOM OF HEAP
250 R1 = R0 + R0
260 IF R1 > N THEN 360
270 IF R1 = N THEN 300
280 IF A(R1) ⩾ A(R1 + 1) THEN 300
290 R1 = R1 + 1
300 IF A(R0) ⩾ A(R1) THEN 360
310 T = A(R0)
320 A(R0) = A(R1)
330 A(R1) = T
340 R0 = R1
```

Table 1. Sort Method — Random Sequence Comparison

Size (N)	1. Brute	2. Bubble	3. Bubble2	4. Insert	5. Shell	6. Heap	7. Quick1	8. Quick2
10	81	45	35	18	24	33	25	54
	10	10	10	10	10	28	8	9
20	361	190	175	93	75	85	61	99
	77	77	77	77	33	75	29	27
50	2401	1225	1147	675	292	266	265	333
	629	629	629	629	137	241	93	84
100	9801	4950	4944	2723	769	627	614	738
	2627	2627	2627	2627	375	577	237	182
200	39601	19900	19795	10475	1796	1457	1431	2051
	10279	10279	10279	10279	811	1357	535	421
300	89401	44850	44184	22005	3180	2362	2524	3147
	21709	21709	21709	21709	1473	2212	900	654
400	159201	79800	79610	39336	4599	3327	3610	4316
	38940	38940	38940	38940	2230	3127	1253	914
500	249001	124750	124597	61439	6057	4311	4605	5791
	60944	60944	60944	60944	3010	4061	1626	1172

```
350 GOTO 250
360 NEXT I
```

At each of the elements 1 to N/2, 2 compares were necessary so that the minimum number of compares involved in this initial ordering is no more than 2*N/2 or N. Since no more than $1+X\text{LOG}_2(N)$ layers with 2 compares each are required to chase an element to the bottom of the heap, the maximum number of additional compares is no more than $N*2*(1+\text{LOG}_2(N))$ or $2*N + 2*N*\text{LOG}_2(N)$. Therefore, the maximum number of compares to place the list in the needed configuration is $N + 2*N + 2*N*\text{LOG}_2(N)$ or $3*N + 2*N*\text{LOG}_2(N)$.

Remember that after the list is in this order, the top element is exchanged with the last element since it is known to be the largest element in the list. The new length of the list is N – 1. The top element is chased to the bottom of the (N – 1) heap, ensuring the top element is again the largest of the remaining elements. This process is repeated until the remaining elements have shrunk to a single element.

The routine to accomplish the final ordering of the list is:

```
400 FOR M = N-1 TO 1 STEP -1
410 T = A(M+1)
420 A(M+1) = A(1)
430 A(1) = T
440 R0 = 1
470 REM CHASE THE TOP ELEMENT TO THE
    BOTTOM OF HEAP
480 R1 = R0 + R0
490 IF R1 > M THEN 590
500 IF R1 = M THEN 530
510 IF A(R1) ⩾ A(R1+1) THEN 530
520 R1 = R1 + 1
530 IF A(R0) ⩾ A(R1) THEN 590
540 T = A(R0)
```

Table 2. Sort Method — Time Comparison

Size (N)	1. Brute	2. Bubble	3. Bubble2	4. Insert	5. Shell	6. Heap	7. Quick1	8. Quick2
10	:01.5	:01	:01	:00.5	:00.5	:01	:00.5	:01
20	:05	:04	:04	:02	:02	:03	:02	:02
50	:35	:23	:23	:14	:07	:12	:08	:07
100	2:23	1:33	1:38	:56	:18	:28	:18	:13
200	9:20	6:07	6:23	3:35	:40	1:05	:39	:34
300	20:30	12:52	13:28	7:17	1:10	1:46	1:06	:52
400	37:00	23:36	24:40	13:22	1:42	2:30	1:34	1:12
500	57:49	36:52	38:30	20:53	2:14	2:58	2:00	1:30

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```
550 A(R0) = A(R1)
560 A(R1) = T
570 R0 = R1
580 GOTO 480
590 NEXT M
```

This process cannot add more than $N*LOG_2(N)$ compares to the total; so, the maximum number of compares for the entire sort must be less than $(3*N + 2*N*LOG_2(N)) + N*LOG_2(N)$ or $3*N + 3*N*LOG_2(N)$. For a nominal table size of 100, this means no more than 2,400 compares. In practice, the number of compares is much less than this number.

Since both the first and second parts of this method require a routine to chase an element to the bottom of the heap, it would seem worthwhile to write that routine as a Basic subroutine. The final Basic version becomes:

```
100 REM      HEAP SORT
200 REM PART 1 - ESTABLISH HEAP
210 M = N
220 FOR I = INT(N/2) TO 1 STEP -1
230 R0 = I
240 GOSUB 500
250 NEXT I
260 REM PART 2 - FINAL ORDERING
270 FOR M = N-1 TO 2 STEP -1
280 T = A(M+1)
290 A(M+1) = A(1)
300 A(1) =T
310 R0 = 1
320 GOSUB 500
330 NEXT M
340 STOP
350 REM   SORT COMPLETE
360 REM
500 REM CHASE AN ELEMENT TO THE BOTTOM
    OF HEAP (LENGTH M)
510 REM TRIO COMPARE ASSUMES THAT R0
    CONTAINS 1ST ELEMENT
520 REM 2ND & 3RD ELEMENTS ARE CALCULATED
530 R1 = R0 + R0
540 IF R1 > M THEN 640
550 IF R1 = M THEN 580
560 IF A(R1) ⩾ A(R1+1) THEN 580
570 R1 = R1 + 1
580 IF A(R0) ⩾ A(R1) THEN 640
590 T = A(R0)
600 A(R0) = A(R1)
610 A(R1) = T
620 R0 = R1
630 GOTO 530
640 RETURN
```

All of the previous methods have attempted to solve the sorting problem from the inside out. Attacking first the order, then the problem of rearrangement. An alternative approach (method seven—Quicksort I) is to solve the problem from the outside in. The problem solving methodology referred to as "divide and conquer" can be applied to the problem of sorting tables of elements. Applied to a list of elements, the concept becomes: 1) Any list of elements containing more than 1 element is hard to put in order; therefore, split the list into two smaller lists. 2) A table of 1 element is easy to put in order.

Next we find a partitioning process which will divide a list of elements into three sublists with the following characteristics: 1) The middle sublist consists of a single element located where it belongs in the final-sorted list. 2) No element of the left sublist is bigger than the middle sublist element. 3) No element of the right sublist is smaller than the middle sublist.

Consider the list of three elements: 20 30 10. This means placing 20 where it belongs, then forcing the smaller elements to the left of 20 and larger elements to the right of 20: 10 20 30. This results in three sublists, each one element long. All sublists are in order within themselves. The sublists are in order with respect to each other; therefore, the entire list is in order. The key to the success of this method will depend on the partitioning routine used to separate the list into sublists.

The first problem is to decide which element is to be moved to its proper place as the middle single sublist. An arbitrary choice of the first element in the list is satisfactory. This element will be referred to as the key element, or simply the key.

Preliminary partitions are formed; the left and right partitions are empty; and the middle partition contains all the elements. The key is compared to the element at the other end of the middle partition. If these two elements are out of order, they are swapped. The element at the end opposite the key is pushed out of the middle partition into the end partition it is next to.

The key is again compared against the element at the other end of the middle partition, and swapped if out of order. Again the element opposite the key is pushed out of the middle partition. By continuing the process of the last two steps, the middle partition must eventually contain only the key.

The element forced out of the middle partition is always in order with respect to the key. This forces the three resulting partitions, or sublists, to have the desired characteristics. (It should be noted that the resulting left and right sublists need not contain any elements. However, an empty sublist does not disturb the overall order relationships.)

After the original list is broken into three sublists, each sublist is treated as a list, and the above process is used to subdivide each sublist until only empty or single element sublists exist. When this has been accomplished, the original list has been sorted. This method of sorting by partitioning is generally called Quicksort and is attributed to C. A. R. Hoare.

The performance characteristics of this method are based on tests of actual random sets of elements, but it is instructive to do a small amount of analysis on the process.

Notice that if the sublists are split evenly, the number of sublists considered will be close to the sum of the powers of 2, which are less than the table size. For example, consider a table of 100 elements. At the first level, 1 sublist of 100 elements is processed. At the second level, 2 sublists of 50 elements are processed. The third level has 4 sublists of 25 elements each. The number of sublists considered is $1+2+4+8+16+32+64$ or 127. This number is one less than a power of two just bigger than the table size.

This is probably the minimum number of compares and swaps possible with this method. Each element is involved in compares approximately seven times (based

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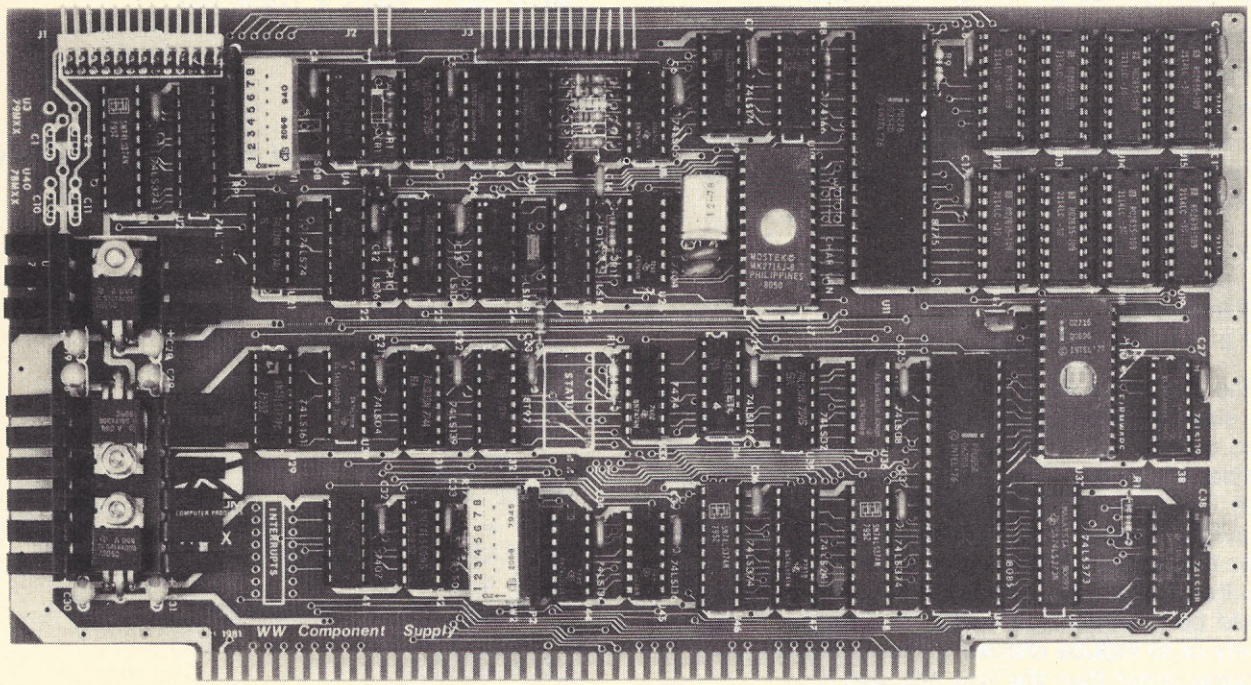

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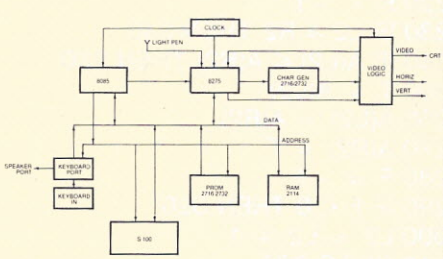

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on the seven levels of sublists). It is more likely that about 100*7 or 700 compares are involved, with the number of swaps somewhere between 127 and 700.

Method seven will require keeping track of the beginning and ending points of sublists. The most often used technique is a stack. In Basic, the stack is simulated by two extra tables and a pointer to indicate how many entries are in the stack-tables.

```
120 DIM L(20), R(20)
130 S1 = 1
```

The stack will originally contain the entire list, since that is to be partitioned. When the stack contains no more sublists, the process is complete and the sort is complete.

```
130 S1 = 1
140 L(1) = 1
150 R(1) = N
160 IF S1 < 1 THEN 430
```

The size of the stack-tables L and R is determined by the size and original order of the table A. Assuming each partitioning cuts the previous sublist in half, the number of elements needed in L and R would be LOG base 2 of N. For a 100 element table, L and R should be at least 7 elements long. If the original table happens to be in approximately reverse order, L and R could be required to hold as many as 33 sublists. A suggestion would be to dimension L and R to one-third of A for safety or to include checks to insure that S1 does not become larger than the size of L and R.

To partition a list into sublists, retrieve the next pair of left and right limits. That sublist is treated as a list and the process is repeated until the stack is empty.

```
160 IF S1 < 1 THEN 430
170 L1 = L(S1)
180 R1 = R(S1)
190 S1 =S1 - 1
200  REM PARTITION THIS LIST
340  REM PUT LIMITS OF SUB-LISTS ON STACK
420 GOTO 160
430 REM SORT COMPLETE
```

The partitioning process is accomplished by saving the original left and right index (L1,R1), setting a flag F to indicate which side of the middle sublist the key is on, and continuing the compare-swap-push loop until the left and right index of the middle sublist meet.

```
200 L2 = L1
210 R2 = R1
220 F = -1
230 IF L2 ⩾ R2 THEN 340
240 IF A(L2) ⩽ A(R2) THEN 290
250 T = A(L2)
260 A(L2) = A(R2)
270 A(R2) = T
280 F = -F
290 IF F < 0 THEN 320
300 L2 = L2 + 1
310 GOTO 230
320 R2 = R2 - 1
330 GOTO 230
```

The limits of newly created partitions are placed on the stack only if the sublist is over 1 element long. Empty sublists and singleton sublists need not be partitioned further.

```
340 IF (L2 - L1) < 2 THEN 380
350 S1 = S1 + 1
360 L(S1) = L1
370 R(S1) = L2 - 1
380 IF (R1 - R2) < 2 THEN 160
390 S1 = S1 + 1
400 L(S1) = R2 + 1
410 R(S1) = R1
```

The complete routine of method seven becomes:

```
100 REM   QUICKSORT - VERSION 1
120 DIM L(20), R(20)
130 S1 = 1
140 L(1) = 1
150 R(1) = N
160 IF S1 < 1 THEN 430
170 L1 = L(S1)
180 R1 = R(S1)
190 S1 = S1 - 1
200 L2 = L1
210 R2 = R1
220 F = -1
230 IF L2 ⩾ R2 THEN 340
235 C = C + 1
240 IF A(L2) ⩽ A(R2) THEN 290
245 S = S + 1
250 T = A(L2)
260 A(L2) = A(R2)
270 A(R2) = T
280 F = -F
290 IF F < 0 THEN 320
300 L2 = L2 + 1
310 GOTO 230
320 R2 = R2 - 1
330 GOTO 230
340 IF (L2 - L1) < 2 THEN 380
350 S1 = S1 + 1
360 L(S1) = L1
370 R(S1) = L2 - 1
380 IF (R1 - R2) < 2 THEN 160
390 S1 = S1 + 1
400 L(S1) = R2 + 1
410 R(S1) = R1
420 GOTO 160
430 REM   SORT DONE
```

By changing the requirements for the partitioning process of method seven, a different version of quicksort (method eight—Quicksort 2) is derived. The pattern of partitioning is modified to divide a list of elements into *two* sublists with this characteristic: no element of the left sublist is bigger than the smallest element of the right sublist.

Instead of the first element in the list, we choose the element at the approximate center of the list as the element to compare against. This element becomes the key element. The process begins by forming three partitions. The left and right partitions are empty and the middle partition contains all the elements of the list.

The left-most elements are checked against the key element and pushed out of the middle partition as long as they are not greater than that key element. The

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right-most elements are checked against the key element and pushed out of the middle partition as long as they are not smaller than that key element. If the middle partition is not empty, the left and right end elements are swapped. These elements are out of order by the previous two steps.

The left- and right-most elements are again checked against the key element and pushed out of the middle partition. The ends are swapped and the process continues until the middle partition is empty.

When the middle partition is empty, the original list has been split into two sublists with the property that no element of the left sublist can be bigger than the smallest element of the right sublist. The modified conditions have been met.

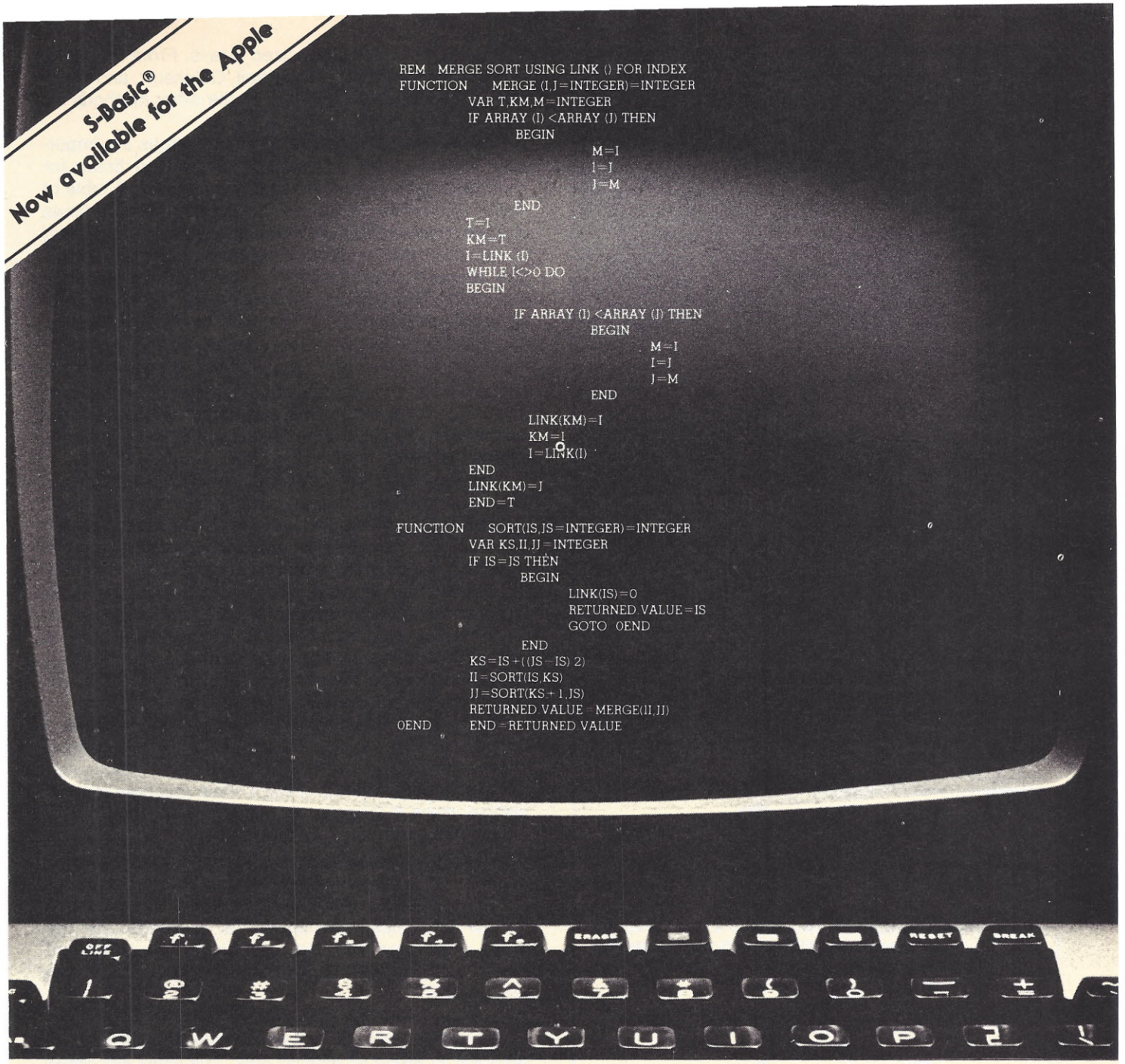
The end points of the right sublist are saved in the stack table and the process repeats on the left sublist. When the left sublist is exhausted, the stack provides the next sublist to work with, and the above processes are repeated. When no more sublists are saved on the stack, the process is complete and the list is sorted.

This method requires one less stacking operation than method seven and hopefully makes a better choice for the key element.

The complete routine is:

```
100 REM   METHOD SEVEN - QUICKSORT 2
120 S1 = 1
140 L(1) = 1
160 R(1) = N
190 L1 = L(S1)
200 R1 = R(S1)
210 S1 = S1 - 1
220 L2 = L1
230 R2 = R1
240 X = A(INT((L1 + R1)/2))
250 C = C + 1
255 IF A(L2)≥X THEN 280
260 L2 = L2 + 1
270 GOTO 250
280 C = C1
285 IF X≥A(R2) THEN 310
290 R2 = R2 - 1
300 GOTO 280
310 IF L2>R2 THEN 340
315 S = S + 1
320 T = A(L2)
322 A(L2) = A(R2)
324 A(R2) = T
330 L2 = L2 + 1
335 R2 = R2 - 1
340 IF L2≤R2 THEN 250
350 IF L2≥R1 THEN 390
360 S1 = S1 + 1
370 L(S1) = L2
380 R(S1) = R1
390 R1 = R2
400 IF L1<R1 THEN 220
410 IF S1>0 THEN 190
420 REM SORT COMPLETE
```

Table 1 is based on a randomly generated sequence of numbers placed into the array A(N). Each entry consists of a pair of numbers. The top number is the count of compares, the bottom number is the count of exchanges. The left column represents the number of



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elements in the different sized arrays. From the table, it becomes evident that the Shell, Quicksort, and Heapsort methods are far superior to the other methods for random sequences.

The number of compares and exchanges are important; however, the comparison of elapsed times for each sorting method is much more dramatic. A table of times is provided below for comparison. These times are based on a 4MZ Z-80 microcomputer and a standard interpretive Basic. Each entry in the table represents the elapsed time to sort in minutes and seconds (MM:SS). The left column represents the number of elements in the array A. The time to sort for the first three methods increases very rapidly as the array size gets large. Recall that the number of compares is proportional to the square of the number of elements in the table. It should not be surprising that the time to sort is also proportional to the square of the number of elements sorted.

The expected improvement between method two and method three is not present; in fact, method three seems to be slower. The extra instructions necessary to check for the condition of a sorted array take more time than the small improvement in number of compares.

Method four (Insert) does generally better than expected due to the savings involved by improvement in the swap method. The big improvement in time comes between the first four methods and the last four. The Shell, Heapsort and Quicksort methods are by far the fastest methods listed.

The number of compares for the last four methods is proportional to the number of elements in the array times the LOG (base 2) of the number of elements. While this does not represent a linear increase in time, neither does it increase as rapidly as the 2nd power functions of the first four methods.

The Quicksort methods require extra instructions to handle the activities associated with the stack of boundary pointers. For small table sizes, this overhead is time consuming. As the number of elements in the array gets larger, the improved algorithms of method seven and method eight will finally overcome this extra effort.

The Quicksort methods are the winners on the basis of the number of compares and swaps, and are also the shortest in terms of time to sort. The Shell and Heap sorts are still far superior to the first four methods. The final choice must be based on which method works best in the particular situation where the sort is required.

A caution is in order. The comparisons are based on random lists. If the original list stays in very good order, you may be better advised to try the Insert sort. Adding a single element to an ordered list is very fast for that method.

It is quite common for Fortran and Basic programs to utilize the Shell method, since this method performs generally as well as the Quicksort and Heapsort methods on medium size tables. If you have an application requiring internal table sorting, it is worth the effort to investigate the Shell, Heapsort and Quicksort methods.

When the most talked about method (the bubble sort) takes over 24 times as long as Quicksort (method eight), maybe it is time to seriously study the faster sorting methods. Even without fully understanding the algorithm, it can be copied and used. The time savings will be worth the effort. □

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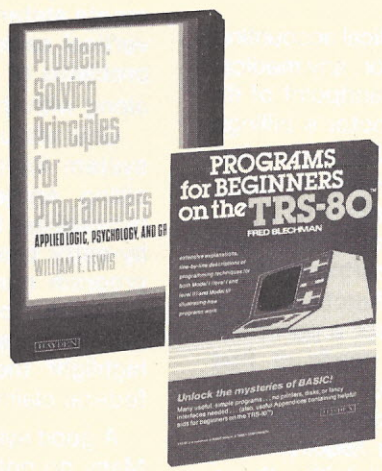

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BENEFITS OF MEDICAL BILLING PACKAGES

by Rocky Smolin

The most important design feature in a medical billing system is the ability to support multi-firm (i.e., multi-clinic) account separation. Also crucial is the capacity to allocate charges, adjustments and cash receipts to a specific doctor within a group.

According to John McKee, account manager at Basic Decisions, Inc., San Diego, CA, many doctors in groups come to a parting of the ways over disputes involving the allocation of adjustments (both within the clinic and from outside services) and the distribution of partial remittances from insurance companies. These adjustments must be posted to the individual physician's account in the data base.

Since this is a prime requirement of medical accounting in situations involving more than one doctor, any medical system should be evaluated from the standpoint of its abilities to separate and report each doctor's billings and allocate charges. The system should also allow the tracking of costs by department—physical therapy, laboratory, X-ray, surgery, ob/gyn, outcalls, etc.

The ability of the package to support billing and charging at several levels—doctor, department, firm, clinic—has implications for every other function of the system. The suitability of any package for a particular environment must be dictated by the needs of that environment. This implies a prerequisite step to any shopping trip for medical billing systems—a thorough analysis of your tracking and reporting requirements and the creation of a written document detailing these needs. This can then serve as a checklist for evaluating a package.

One of the most time consuming, tedious, and error prone procedures in the medical office is the completion of insurance forms. The ideal system will fill in the blanks on a continuous report form. This will be supplied by the insurance company; or a standard form that satisfies the firm's requirements will suffice. The system should be able to handle multiple diagnoses as well as multiple insurance billing for the same patient. one insurance company will pay part of the bill; a nd company will pick up the remainder.

The less manual entries required on the insurance form, the more desirable the system. The appearance of the information on the insurance form implies that this information was collected by the data entry program. When evaluating this aspect, be sure to look at both output and input.

Another useful feature is 'cycle billing'. Under this arrangement, the billing program will pick up a subset of all the patients in the data base each day (i.e., A-E on Monday, F-J on Tuesday) and generate billing for them. This creates a smooth cash flow for the clinic.

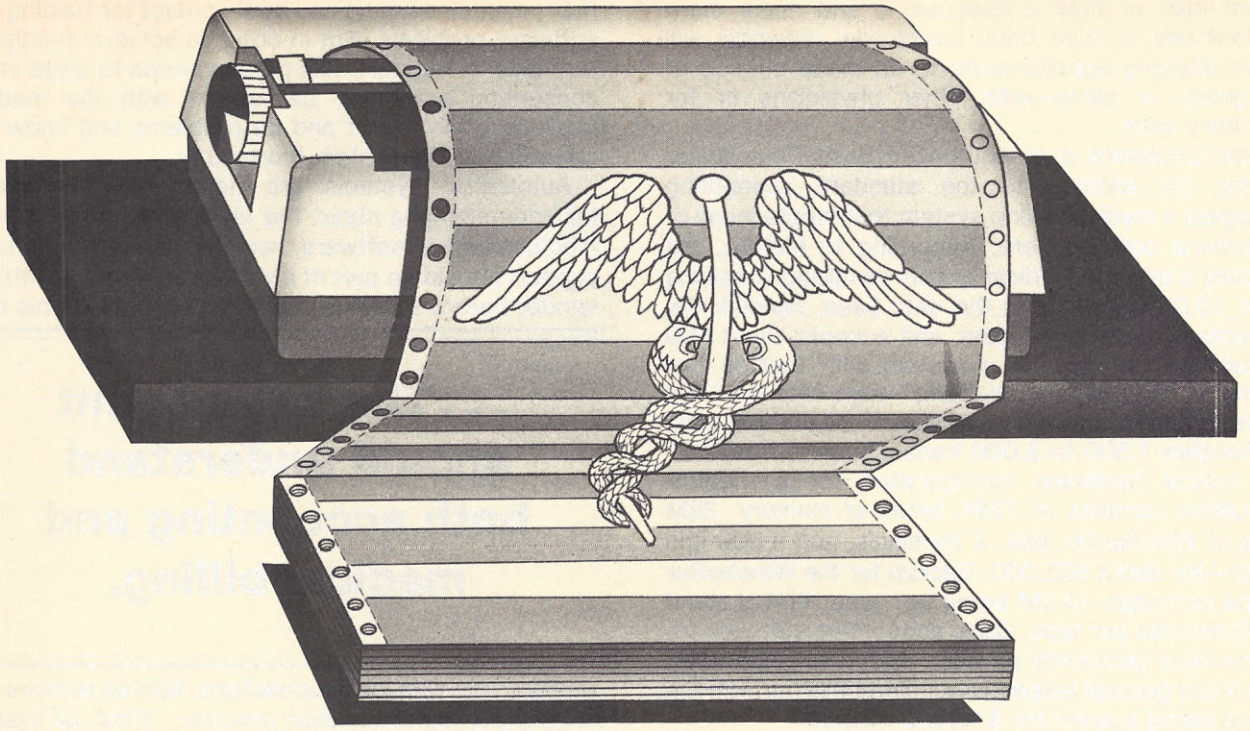
The system should be able to bill patients as well as create statements for all outstanding receivables. Most vertical packages (software designed to address the problems of a specific industry or profession) are sold along with the other standard accounting packages.

One should investigate the degree to which the system interfaces with the accounts receivable. Do billing entries automatically create entries in the receivables files? Does it do this on-line, on an entry-by-entry basis, or in a batch mode where a posting program must be run periodically? If not, does the package provide an aged receivables and a delinquent accounts report? Finally, the aging report should highlight the insurance claims, as some state and federal claims expire after six months.

A good system should allow for installment payments. Many do not, but in the real world of medicine, partial payments are a fact of life. Your system should support this fact.

Check for the ability of the cash applications function to apply cash automatically to the oldest outstanding charges at the option of the user. Patients will often remit a lump sum covering many charges. Manual posting of 10 or 15 charges would obviously take much more time and be prone to error. However, the system must allow the user to override automatic posting any time, since some remittances are tied to specific charges.

If the system interfaces with an accounts receivable package, how are cash receipts handled? Be sure to



work through a couple of transactions to find out. Does the receipt go in through the A/R package and update the medical system's files, or vice-versa?

How does the system handle bad debts or write-offs? What happens when the insurance company pays 80% of the bill and the doctor wants to write off the other 20%? Where does it go? Look for the degree of interface provided to the general ledger package. At a minimum, all accounts, charges, departments, etc., should allow a general ledger account number to be included in the record or transaction. Even if no posting is done directly to the G/L, manual entries can be significantly eased by using reports sorted by G/L account number.

Versatility required

It is in the area of recording charges and expenses that the ability to record by department, by doctor, by patient becomes paramount. A system that does not do this may still be adequate for a particular situation. But one must ask how much manual effort will have to be expended in order to duplicate this function. How much manual work is currently being done to distribute charges and expenses? Is this tolerable? Would a system that automated all other functions—but left this to the discretion and fallability of the bookkeeper—still be worth the expense and effort of installation? Careful evaluation here is required in order to avoid buying an inadequate system.

In addition to insurance forms and patient statements, a good system will create periodic physician activity reports showing all billings, adjustments, and charges for a given date window (usually monthly).

One should also expect consolidated financial statements covering the entire clinic, as well as subsets of these reports for a particular doctor, department, or group.

Audit trails are printed reports of all activity on the system that changes, adds to, or deletes information in the files. A complete audit listing will allow recreation of all activity on the system. Hardware is fallible and occasionally a disk drive will fail, or a floppy disk will go bad. Even more likely are operational errors by the person entering data, running update, reporting programs, or making copies of the data files. When this happens one usually has to go to the most recent backup or complete copy of the files and use these as a starting point to recreate the information. Using the audit trails (they may be called transaction listings or activity reports), one should be able to reconstruct all activity from the time the backups were made until the failure of the hardware or human.

There is no substitute for actually trying this process before buying a system. Although it is time consuming, it will definitely be less costly than trying to reconstruct data files from inadequate or missing audit trails. Do not consider any system that does not provide this feature.

Much of the busy work around the group medical practice involves making appointments for patients, trying to schedule them with other specialists in the group, remembering to call and remind patients of appointments on a given day, and preparing the charge slips.

An automated appointments calendar solves many of these problems. In this system, each doctor's appointments are recorded and are made available for on-line inquiry. In a multi-terminal system where each physician might have a terminal in his office, each doctor can make appointments for his patients with the other doctors in the group by using on-line retrieval. This will indicate what that doctor's schedule is and what open time exists.

Each day before the office opens, the system should print out the daily appointments calendar for each physician; a pick list for the secretary so that the patient's files can be pulled out; and charge slips for each patient.

The centralization of all the appointment calendars will prevent overload. Each doctor can block out golf time several weeks in advance, preventing anyone else from scheduling that time. They can see what the

patient load of their colleagues is and make more efficient use of their time. Eventually, networks will evolve allowing appointments to be made outside of the group or clinic—with other physicians or for laboratory work.

Basic Decisions is an authorized Basic/Four dealer offering (in addition to the standard accounting packages) a medical billing system that meets many of the criteria outlined here. According to McKee, the company's average medical system installation contains about 10,000 patients in the data base, handles the accounts of three physicians, and accepts about 500 transactions per day on a system with four to five terminals. "Our biggest system," says McKee, "has twelve terminals, a data base of about 120,000 patients, and handles 1,500 to 2,000 transactions per day".

A typical hardware configuration for a medical application consists of 128K bytes of memory, 28M bytes of Winchester disk, 4 terminals, and a 300 lpm printer—for about $35,000. Backup for the Winchester is tape cartridge—9.2M bytes per tape, taking about 15-20 minutes per tape. Basic accounting software for the machine (accounts payable, accounts receivable, payroll and general ledger) is bundled together with the patient billing system for $10,000-12,000.

McKee says procurement of all hardware and software from a single source is preferable. No on-site programmer maintenance should be required. The system should be turnkey, user oriented, and very forgiving. All systems should integrate with the general ledger.

Above all, he warns, prospective buyers should find a sales agent who understands both accounting and medical billing. The sales agent is always the client's first (sometimes only) and best contact for training and software problems. But in order to achieve a satisfactory level of support, this person needs to understand accounting practices, be familiar with the medical practice environment and its problems and know the operation of the system thoroughly.

Automated systems are never easy to install. Misunderstanding about the level of support, custom modifications of software, hours of training and on-site support should be part of a written agreement with any vendor before a deal is made. To account for his high success rate with local installations, McKee outlines the company's implementation process. "First, all system specifications are signed off by the buyer including any custom software modifications. We do the initial general ledger setup for them and give them three to five days of testing the system with their data in our offices. All this occurs before the machine is delivered. After delivery we provide up to forty hours of on-site training. But because of the thorough pre-training, generally only ten to fifteen hours are required." □

. . . The sales agent should understand both accounting and medical billing.

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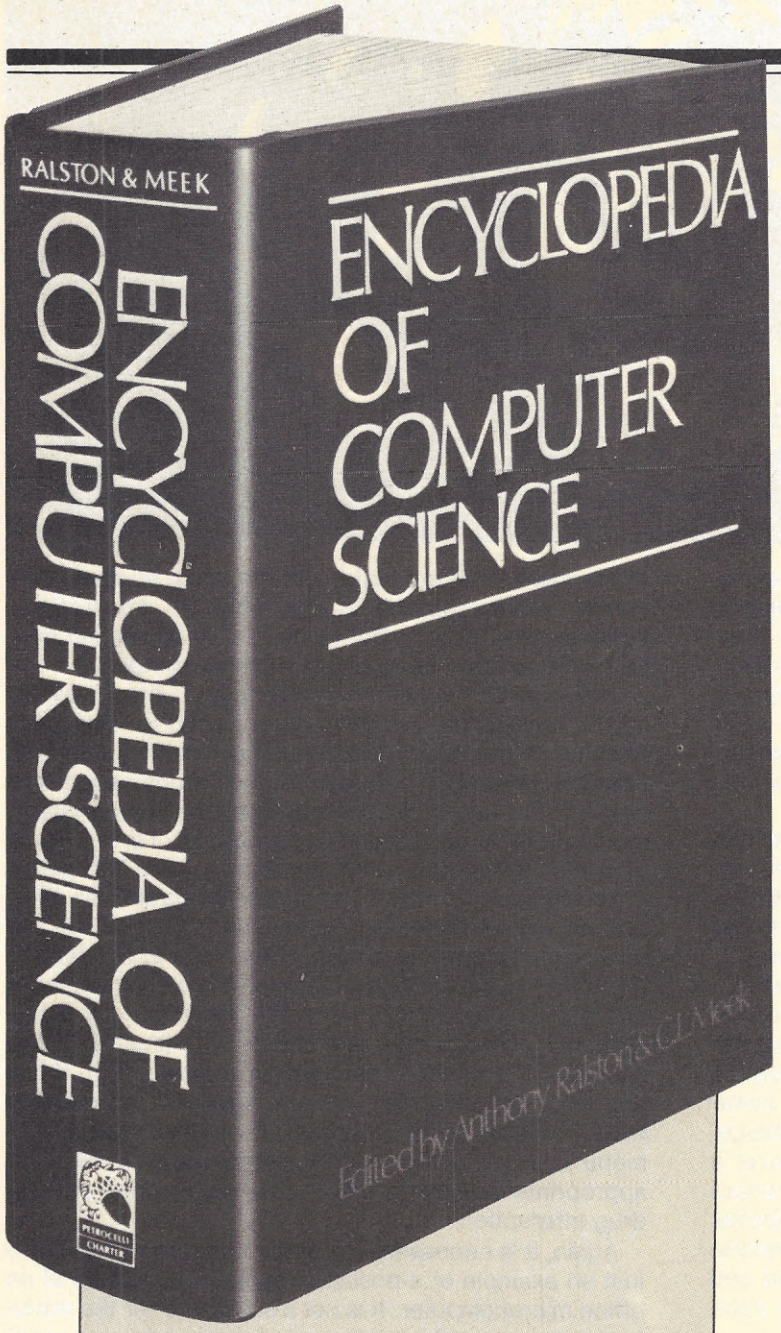

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DRUG INTERACTIONS

by Albert B. Accettola, M.D.

One of the things that a physician does almost every day is to prescribe medications. While most physicians use a relatively small number of medications in their practices, it is not uncommon for patients to be taking drugs prescribed by several doctors for different ailments. As these substances can interact with each other within the body, it is necessary to take into account what a patient is already taking when prescribing new medications.

Drug interactions can be extremely complex, and it is very difficult to keep track of more than a few of the most common ones that are seen in any given practice. Entire books have been published about drug interactions, and some of the commercial pharmacy programs can search for these complications of multiple drug therapy.

The following program can be used on an office microcomputer to help search for drug interactions with a minimal loss of time. It is not a complete list of potential drug interactions, but is only a guide to some possible interactions between commonly used drugs. The program is not a substitute for the manufacturer's recommendations and precautions, and the product literature should always be consulted on any unfamiliar medication. This program is intended to demonstrate how different types of interactions can be coded and placed in a matrix that can then be searched for each possible combination.

The basic format used is a 16 by 60 matrix which is derived from work done by the Department of Materia Medica, University of Glasgow and the Scottish Home and Health Department to develop a pocket sized guide to drug interactions. This device is commercially available under the name of Medisc.

This program goes a little beyond the pocket sized Medisc in that several names (both generic and the various brand names) can be used for each drug represented in the 60 columns of the matrix. This is done by assigning a number from 1 to 60 to each drug, corresponding to the column number. Different names of the same drug are just given the same number. The matrix, which represents the possible interactions between the drugs, is not limited to 16 by 60; but may be made as large as available memory permits.

The program works by first setting up the 16 by 60 matrix, and placing a code number from 0 to 13 in each position of the matrix. Each number corresponds to a possible interaction between the two drugs concerned (table 1). A menu of 16 basic groups of commonly used medications is then presented (table 2). To test for a possible interaction, select the drug you are interested in by number from the menu; the program will then prompt you for the name of the second drug. If you are unsure of the spelling, simply enter the first few letters and the program will search through the data statements and list all the drugs in the file starting with those letters. If there is only one match, it is located in the matrix, and the type of interaction is printed out. If the search of the data file turns up several drugs starting with the same letter or letters, they are presented in menu fashion, and it is only necessary to select the appropriate number for the program to print out the drug interaction.

Again, it is necessary to point out that this program is just an example of a possible medical application of an office microcomputer. It is not a substitute for the manufacturers' prescribing information, and certainly cannot replace the clinical judgment of the prescribing physician.

The program was written in Computerware Random Basic for a 6800 or 6809 computer. It should be very easy to translate it to most dialects of Basic. The only special commands are HOME in lines 200 and 600 and LINE = 0 in line 20. HOME is used to clear the screen and move the cursor to the upper left corner. LINE = 0 is used to turn off the automatic carriage return / line feed of this Basic. □

Program on page 154

Table 1. Examples of Possible Interaction

0 - There is no interaction between the two drugs.

1 - The effect of the first drug is enhanced.

2 - The effect of the second drug is enhanced.

3 - The effect of the first drug is diminished.

4 - The effect of the second drug is diminished.

5 - Uncertain clinical significance in man.

6 - The drug interaction is potentially dangerous.

7 - The effect of both drugs is enhanced.

8 - The effect of both drugs is diminished.

9 - The effect of the second drug could change up or down.

10 - The effect of the first drug could change up or down.

11 - The effect of the first drug is enhanced while the second is diminished.

12 - The effect of the first drug is diminished while the second is enhanced.

Table 2. Menu of 16 Basic Medication Groups

1 - Monoamine oxidase inhibitors

2 - Tricyclic antidepressants

3 - Coumarin anticoagulants

4 - Oral contraceptives

5 - Guanethidine

6 - Diphenylhydantoin (Dilantin)

7 - Aspirin

8 - Levodopa

9 - Aminoglycoside antibiotics

10 - Beta blockers

11 - Thiazide diuretics

12 - Oral hypoglycemics

13 - Barbituates

14 - Alcohol

15 - Digoxin

16 - Iron

ADVANCES IN SPEECH SYNTHESIS

by Bernard Conrad Cole

The growth trend in the use of home and business computers will be significantly enhanced if human speech can be used for a major percentage of input/output communications.

Using a variety of new semiconductor fabrication and circuit design techniques and combining them with what has been learned about speech digitization, analysis and compression, numerous companies have introduced systems and components addressing the areas of speech synthesis; speech storage and retrieval (voice letter box); and low bit rate speech transmission.

According to SRI International, Menlo Park, CA, the above markets will exceed one billion dollars by the mid-80s. It could double or even triple, according to some estimates, if the related area of speech recognition is susceptible to solution. Primitive, first generation speech recognition schemes have been developed, but the complete solution requires more than understanding the characteristics of speech formation. It also requires understanding the very process of language and thought. As a result, new findings in artificial intelligence research will play an important role in its development.

Because of the entrance of numerous semiconductor firms into the marketplace, computer speech I/O technology is becoming much more affordable. Initial devices have focused on speech synthesis, a reflection of the fact that speech recognition is the more difficult problem technically.

The digital speech business is so new that there are relatively few skilled engineers and scientists who have devoted sufficient time to the field to become experts. In addition, there does not exist a single, independent company solely devoted to all aspects of digital speech—analysis, synthesis, transmission and recognition.

Prior to the last few years, almost all transmission and storage of speech was done in the analog world. The advent of digital computers has caused increased interest in digital representations of speech.

Different methods

Waveform digitization is the earliest approach taken for speech synthesis. It relies on sampling of the waveform in the time domain at twice the highest frequency of interest (known as its Nyquist rate). Included in this category are such voice waveform digitization methods as pulse code modulation (PCM), differential PCM, delta modulation, continuous variable slope delta modulation and adaptive predictive coding. For bit rates much below 20 to 32 kbps, these techniques generally involve complex processing and often produce speech that sounds synthetic.

Pulse code modulation (PCM) is a technique that captures specified words and phrases, amplifies and digitizes them at a high sample rate with an analog-to-digital converter. The relative weights of the samples are stored on a ROM, disk or digital tape recorder. Data representing the samples are not massaged or altered but merely played back by reconversion into an audio signal with a digital-to-analog converter. If the audio signal is converted and reconverted at the same sample rate, the output of the system replicates the recorded voice with reasonable accuracy.

The PCM method encodes each waveform sample independently of all others. For most signals, however, the average amplitude change from one sample to the next tends to be small, compared with the overall limits of the signal-amplitude change. When two adjacent samples have the same (or nearly the same) amplitude, it is redundant to transmit both values.

Differential PCM eliminates this redundancy by encoding the differences between samples, rather than their actual amplitudes. An advantage of this technique is that the average amplitude variation from sample to sample is much less than the total amplitude variation; thus fewer bits are needed.

What DPCM actually encodes is the difference between a current amplitude sample and a predicted amplitude value estimated from past samples. The past samples are weighted so as to minimize the average energy of the difference signal. Calculated using long term statistics of a representative sample of speech, these weights remain fixed for any given DPCM system. A DPCM system using one past sample utilizes one less bit per sample than an equivalent PCM encoder, while one using three past samples eliminates 1.5 to 2 bits per sample. Beyond this, little is gained.

Adaptive predictive coding (APC) is an attempt to extend the DPCM scheme. One approach uses variable, rather than fixed weights, updated every 10 to 30 mS. Another

APC technique uses a predictor whose form is based on redundant speech characteristics to obtain more efficient representations of voice waveforms.

Delta Modulation (DM) trades flexibility in audio output for a low data rate and correspondingly lower costs. Only the amplitude changes from one output to the next are specified. Unlike PCM techniques, in which information is stored in parallel in ROM, serialized data bits representing spoken words are stored, and a controlling microprocessor simply scans the appropriate ROM addresses according to keyboard activity. ROM output data are serialized and used to drive an audio output up or down, thus replicating the previously recorded voice. The serial method does not have as much flexibility and its fidelity is less than ideal. However, its reduced cost and simplified circuitry make DM a useful approach in telephones and other cost sensitive applications. Telesensory Systems uses DM techniques in its products.

Two major problems DM suffers from are slope overload and idle noise. The first occurs when the signal levels are too large and the second when they are too small. In both cases, the problems can be resolved through gain control techniques. For instance, continuous variable slope delta (CVSD) modulation adapts to vary gain over a continuous range. Variable slope delta (VSD) modulation adapts on the error signal, and digital controlled delta (DCD) modulation uses a digital comparator operating on the error sequence to control the gain function.

Formant synthesis

Another technique is formant synthesis, a parametric method for modelling the natural resonances of the vocal tract. In this approach, the time varying spectral parameters of speech (the frequency and energy content of a speech signal) are reconstructed, or synthesized. Several methods are used to extract and encode spectral parameters. The bands of frequencies that these parameters define are called formants, which are the major resonant frequencies of speech. In electronic speech synthesis, formants are produced by either analog or digital filters. The excitation signals driving these filters are both periodic and random waveforms that emulate vocal pitch and the sounds of turbulent air generated during speech.

Formant synthesis requires a moderate bit rate and offers good reproduction of speech characteristics. The ultimate in low bit rate speech synthesis is a formant technique called phoneme synthesis, in which the spectral parameters are derived from the basic word sounds. A key element in phoneme synthesis is a phoneme code to parameter translator, which makes it unnecessary to analyze speech.

Linear predictive coding

With formant synthesis, voiced sounds are generated from an impulse source that is modulated in amplitude to control intensity. The resulting signal is passed through two levels of filtering. Unvoiced sounds are generated as white noise and passed through a variable pole zero filter. A second filter used for voiced sounds can also be reused for unvoiced sounds. The coefficients for these filters are stored in ROM, with about 400 memory bits required for each second of speech.

Linear predictive coding is very similar to formant synthesis in that both are based in the frequency domain and both can use similar hardware. A basic difference is that LPC uses previous conditions to determine present filter coefficients. The quality of the synthesis improves as the number of coefficients increases. With ten coefficients, about 1,200 bits are required for a second of speech. LPC attempts to extract the significant features of speech from the time waveform rather than from the frequency spectrum.

The LPC approach uses a weighted sum of n past-samples to estimate the present sample. The weights are calculated to minimize the average energy in the error signal that represents the difference between the predicted and actual speech amplitude. Unlike differential PCM, where the weights are calculated once over all speech and then remain fixed, the weights in predictive coding are calculated over short speech segments of 10 to 30 mS and, thus, change as the speech statistics vary.

The standard LPC techniques also differ from adaptive predictive

coding schemes. In the latter, it is the error signal (the difference between predicted and actual voice wave form samples) that is transmitted. However, LPC systems transmit only selected characteristics of the error signal. These parameters include gain factors, pitch information, and voice-unvoiced decision information, which allow approximation of the correct error signal used to excite the filter formed from the predictor coefficients and thereby generate a synthetic speech signal.

The problem with the present LPC techniques is in trying to come up with an approach that is reasonably low in cost, but can approximate good to excellent quality speech at low bit rates.

With current LPC techniques, it is possible to achieve low cost and low bit rate, but only by sacrificing speech quality. In some consumer oriented products, LPC techniques are used, allowing a low bit rate—2.4 kbps—but the result is a Donald Duck quality to the speech. On the other hand, there are LPC techniques, which allow good quality speech representation at 5.6 to 9.6 kbps—but are also very expensive.

With the wide availability of speech synthesis techniques, advanced semiconductor processing and a number of promising new markets, numerous speech synthesis chips and boards are being introduced.

Texas Instruments, Dallas, TX, with the success of its Speak and Spell products, is mounting an aggressive marketing effort in the speech synthesis market, offering a two chip set consisting of the TMS5100 synthesizer and the 128K-bit TMS6100 ROM—which holds 100 words. The p-channel MOS devices use the firm's LPC technique to generate speech.

For interfacing to 8 and 16 bit microprocessors, TI offers the p-channel MOS TMS5200 synthesizer chip. Unlike the TMS5100, this has a 128 bit first-in, first-out memory for interfacing to microprocessor controllers. The firm has also introduced TM990/306 speech synthesizer module for users who want to develop its own vocabulary.

Speech processor chips

National Semiconductor's (Santa Clara, CA) Digitalker family of devices operates at low data transmission rates (between 400 bits/second to 2K bit/sec.) to make it less dependent on large amounts of memory. It contains a speech processor chip (SPC) and a ROM. The SPC addresses up to 128K bits of ROM directly and is expandable with a minimum of external logic. Communication is established between the SPC and ROM, which stores compressed speech data, as well as frequency and amplitude information required for speech output.

From American Microsystems, Santa Clara, CA, comes the single chip S3610, an LPC synthesizer with an on-chip ROM that can hold up to 20 kilobits of data. With this much storage, the device can hold up to 32 words without external memory. Another LPC chip, the S3620, is similar to the 3610, but draws its speech data from an external memory. A microprocessor compatible interface allows the processor to load data with or without a DMA controller.

Phoneme synthesis

From General Instruments, Hicksville, NY, comes the SP-0250, an n-channel MOS/LSI device capable of producing voice output under the control of 15 programmable parameters. It is one of six primary building blocks in a complete system that includes a vocal tract model consisting of LPC synthesizer. This connects to a pulse width modulated d-a converter, which drives the audio output stage. To allow the voice generator to operate with a controlling microcomputer, a 15 byte first-in, first-out memory is included on-board.

Phoneme synthesis is used by Votrax (Troy, MI) in its SC-01, a CMOS speech synthesis chip that requires six input lines to select one of 64 different phonemes, two inputs for inflection level setting, a strobe pulse to latch the phoneme code, and an acknowledge request line. Initially it is being used in two board level products, including the VSM/1 versatile speech module, which also incorporates a 6800 microprocessor, parallel and serial interfaces, 1K byte of RAM, and 8K bytes (1300 spoken words) of prestored vocabulary ROM with expansion sockets for an additional 8K bytes of memory.

Although its previous efforts were built around delta modulation techniques, Telesensory Systems' (Palo Alto, CA) newest effort, the

Speech 1000, is a board-level LPC speech synthesis system that will provide 200 to 300 seconds of male or female speech in any language. Based on Intel's 8085 8-bit microprocessor, the Speech 1000 features 458K of on-board ROM, programmable speech control and audio gain, and three I/O ports: one for Intel's multibus, another for an RS-232 serial interface and a third 8 bit parallel interface.

Exciting the filter

Key to the operation of the board is a programmable digital signal processor (PDSP) module, containing two MOS/LSI chips, one an arithmetic unit (the A chip) and an interface control chip (the B chip). The A chip supplies the multipliers, adders, and storage registers required to implement a digital filter having a variable frequency response modeling the acoustical behavior of the human vocal tract.

Speech sounds are synthesized by exciting the filter with a digital impulse train generated by the B chip. To compute each waveform sample, the A chip performs a series of operations controlled by a single pass through a short stored program and outputs a 10 bit result directly to a D/A converter. Storage of the filter program, coefficients, and partial results are provided by standard RAM chips externally connected to the A chip, allowing programs to be changed at will by the user.

Centigram Corporation (Sunnyvale, CA) uses PWC, a proprietary speech encoding and data compression technique to produce highly intelligible speech at a low bit rate. Like LPC, PWC has a moderate data rate using a minimum of memory for word storage. But unlike LPC, it does not lose the total qualities of the speech because it retains the phase relationships of the spectral elements or frequency components. The speech quality is comparable to waveform digitization, which also reconstructs the amplitude waveform of the voice signal, rather than just the frequency components. By comparison, waveform digitization without speech compression has a prohibitively high data rate.

Another advantage of PWC is that it is event driven. Segments of voice information are deliniated by natural changes of the spoken passages rather than artificial time frames, as with LPC. Thus, it more easily adapts to packet switched networks, because its naturally segmented voice produces better sounding speech when reconstructed, opening up the potential for use in store and forward systems.

It is being used initially in Centigram's new voice output system, called Lisa, for logically integrated speech annunciator. It is available as either a standalone terminal containing selftest and host driven diagnostics or as a board level product. It has an internal speaker, but can be hooked up to an external speaker or to a telephone line. Its output is almost indistinguishable from a voice recorded on a standard tape recorder. In typical applications, a host computer program contains the digitized sentences. The computer downloads the sentence or sentences as needed into Lisa's RAM, which can then store up to one minute of speech.

Using a partial autocorrelation technique (Parcor—similar to LPC), Hitachi's (San Jose, CA) synthesis system is a three chip set: the HD38880B synthesis chip containing the logic circuits for synthesis, excitation, filtering, d/a conversion, and speaker driving. The HD38881 is a 128K bit mask programmable ROM, and the HD38882 provides an interface function. For large vocabularies, the system can support up to 16 similar sized ROMs, with each storing the equivalent of 50 to 100 seconds of speech data, about 200 words at a low speed rate.

Adjustable speed

Similar to the Hitachi unit in that it also uses the Parcor technique, Matsushita Panasonic's (Seacus, NJ) MN6401 features 32K bits of on board ROM, but accepts external ROMs for large vocabularies. As with the Hitachi system, speech speed is adjustable, and the single chip synthesizes both male and female voices.

Nippon Electric (Melville, NY) is offering a general purpose single chip microcomputer, the uPD7720, capable of processing speech signals.

In Europe, ITT Semiconductor's German-made UAA1003 speech generator is an n-channel MOS device with two on-board ROMs. Integrating the memory onto the

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chip gives a vocabulary of about 20 words, as well as control decoding and d/a conversion functions. The American division of ITT is in W. Palm Beach, FL.

Products that offer speech synthesis are particularly useful because they can prompt a human operator with leading questions as well as confirm data entries aloud. Where appropriate, such products can be used to check for anomalies in the input data and ask additional pertinent questions, permitting human operators to work with them as they might with a human assistant.

The availability of digitized speech at relatively low cost now makes possible a whole range of products to store, retrieve, switch and transmit messages in a manner not possible with analog representations of speech.

The primary beneficiary and user of this technology will be the telephone companies in their store and forward voice switching systems. The 1985 market is forecast at $1.2 billion, with the 1990 market at $3.1 billion.

Another market area amenable to penetration using speech synthesis techniques lies in the area of low bit rate speech transmission. With sales of about $15 million a year this market has several categories.

Secure Voice is primarily a military market but the applications of commericial secure voice are slowly but surely increasing as the costs come down. The U.S. government has a major Secure Voice Network that is going to be upgraded within the next few years with better speech quality. It turns out that voice quality at 2.4 and 9.6 bps are the main features of this market.

Speech capability economical

The Trans-Ocean market results from the cost savings associated with stuffing four voice channels at 2.4 kps down a single voice channel.

Several timesharing networks have high capacity trunks that are inefficiently used for large portions of the day. It would be economically advantageous to add digitized speech capability at virtually zero incremental cost. Tymshare, Transpack, Telenet and Arpanet have all public expressed interest in packetized voice.

56 KPS Digital Transmission is another major force in this category. There is every indication that the Bell System will make 56 kps lines as part of its standard DDS system. In addition, SDS, AMSAT, RCA and Western Union are all offering satellite channels with similar capabilities.

The economics of such multiplexing are compelling, but the world is running out of parking orbits at the equator with the limited frequencies available.

Not to be ignored is the market for speech synthesis in toys, games and portable educational products with firms such as Entex Industries, Milton Bradley Co., Mattel Electronics, Mego Corp. and Tiger Electronic Toys, Inc.

In many respects, it is the personal computer user who will be the primary beneficiary of this accelerated activity in speech synthesis, both directly and indirectly.

Predictions

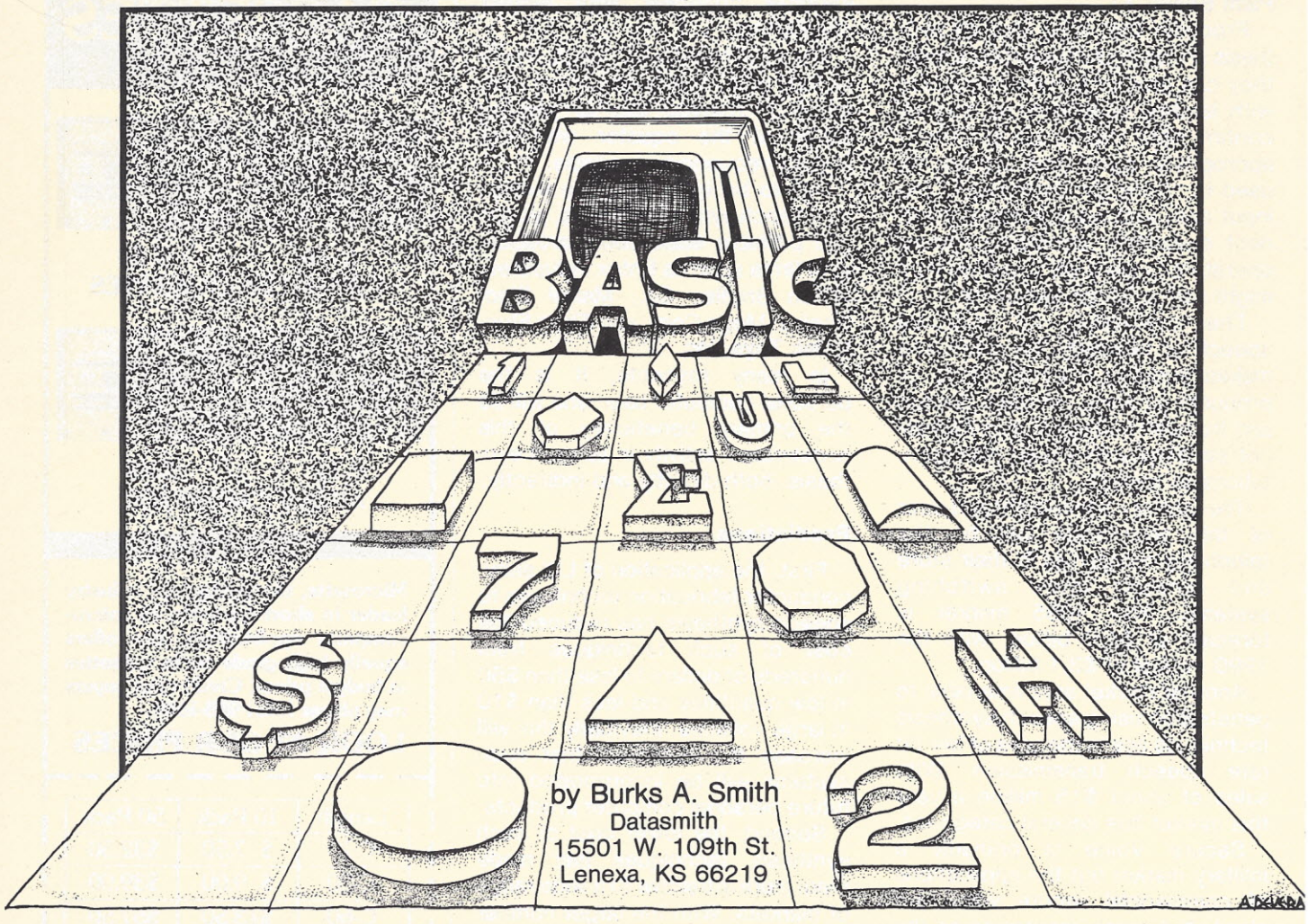
First, the application of LSI semiconductor fabrication techniques to speech synthesis has reduced the cost of such techniques from hundreds of dollars to less than $50 in low quantities and less than $10 in large volumes. Inevitably this will increase the likelihood that such systems will be incorporated into future personal computer products.

Second, the lower cost of such synthesis techniques has made them more attractive to a wide range of markets. With the larger number of users, economies of scale come into play, further reducing the cost of such techniques.

Third, many of the techniques for low cost speech synthesis have direct application on the speech recognition side of the equation. When combined with new artificial intelligence techniques just now emerging from the laboratories, truly low cost speech recognition will be possible. Indeed, the increased interest in speech I/O may hasten the commercialization of AI-developed techniques.

Finally, digital speech synthesis may ultimately lower the cost of using the many information and data networks, bringing them into the range of the personal computer user. At present, most computer networks are under-utilized, and are thus expensive. By using packet networks and such to transmit synthesized and compressed digital speech patterns, lower usage costs will result. □

USING MICROPOLIS BASIC



by Burks A. Smith
Datasmith
15501 W. 109th St.
Lenexa, KS 66219

Micropolis Basic is one of the most powerful versions of Basic available. It is a large interpreter, occupying the first 24K of RAM. It takes at least a 32K system to use it at all, and more memory is advisable if you intend to write long programs without having to chain them.

Interestingly, this version of Basic does not require a separate operating system. There is an operating system called MDOS included with the software package, but when Basic is loaded, MDOS is almost completely overwritten in memory. The only code that MDOS and Basic have in common is the custom-configured I/O module needed to communicate with the terminal and printer. In fact, it is a simple matter to make a system disk that boots directly to Basic without having to load the operating system first.

The majority of commands used are typical of those found in other extended disk Basics. A complete inventory of general mathematical and trigonometric functions is provided, along with full string handling, including string lengths up to 250 characters and three-dimensional string arrays. Also included are extensive editing and renumbering features. However, there are some unique features that greatly add to the versatility of the system and deserve special mention.

The precision of a variable stored in a computer's memory depends on how much storage space is allocated to that variable. What this means to the user is that he has only a certain number of significant digits available in any mathematical operation. This may not be important for balancing a checkbook or simple calculations, but for keeping the books of large companies or for certain engineering purposes, it becomes a major consideration.

For instance, accurately storing a sum of money in the $10 million range down to the last cent requires ten significant figures. Most larger versions of Basic have provision for using either single or double precision variables through some sort of assignment statement, but Micropolis Basic allows the user to specify exactly how much storage is used with what is called a SIZES statement.

For example, the user may specify that the precision may be anywhere from four significant figures all the way up to a mindboggling 58 figures for accuracy freaks. The use of the SIZES statement allows good memory management, since you only use the accuracy you need for a particular program.

Almost all extended Basic versions make use of the PRINT USING command to format a numeric value for output. The command takes a numeric value and formats it according to a picture of the desired output form represented by a string variable. Therefore the

command PRINT USING A$ X will output the variable X according to a format determined by the value of A$.

Micropolis does things differently. Instead of a PRINT USING command, it provides a format function (FMT), which requires a string value determined in the same way PRINT USING works. In Micropolis Basic, PRINT FMT(X,A$) performs exactly the same function as the PRINT USING statement above. In other words, the value X is formatted according to the value of A$. While this may seem like simply a different way of doing the same thing, it provides flexibility that may not be immediately obvious. For example, with the FMT function, several values may be formatted differently in the same PRINT statement as follows: PRINT FMT(X,A$) ,FMT(Y,B$) ,FMT(Z,C$).

In this example, the values X, Y, and Z are each formatted according to a different picture represented by A$, B$, and C$, respectively. To do the same thing with PRINT USING would require three separate statements. Also, it should be noted that FMT is a general function, and does not have to be used in conjunction with a PRINT statement. It can also be used to convert a numeric variable to a string with a specified format anywhere in the program.

Unique numbering system

Normally, any number appearing in a program or input from the keyboard is assumed to be in base 10 arithmetic; but Micropolis Basic allows numbers in any base. This is done by using an optional notation system called Radix Format. For example, in the notation 2R10110, the 2 means that the number is base 2, the R specifies Radix Format and 10110 is a binary number that evaluates to 22 in decimal. Similarly, the notation 16R1E0A is the hexadecimal number 1E0A.

This type of notation is useful when it is inconvenient to translate a hex, octal or binary number into decimal for use in a program or as input. For simple conversions, the PRINT statement will also print a Radix Format number's decimal equivalent on the terminal. Radix Format accepts any base that can be represented in the digits 0 through 9 and the letters A through Z, making the use of bases from 2 to 36 possible.

Efficient disk file capabilities

The most powerful feature of this version of Basic is undoubtedly the disk file handling. Unlike other versions where disk operations are performed through an operating system that may be configured for a variety of different types of disk drives, Micropolis Basic is designed only for Micropolis (Chatsworth, CA) disk drives. The media used is a 5¼-in. mini diskette with 16 hard sectors for each of the 77 tracks. One of the tracks is dedicated to the disk directory, so users have access to 76 tracks with a total of 1216 sectors—each capable of holding 250 bytes.

Disk space is allocated to a file a track at a time and is totally dynamic. Basic keeps track of which tracks are free and will allocate additional space for a file as it is needed. This eliminates the necessity of defining the size of a file in advance and makes programming very easy. A single file may occupy as little as a single track or as much as the entire disk. Deleting a file immediately makes its space available for other files.

All file access is done with PUT and GET statements, which function in exactly the same way as PRINT and

INPUT statements and access one physical sector of 250 bytes. In fact, Micropolis uses the identical logic for accessing the printer or terminal that is used to access a disk file. To print on the printer rather than the terminal, for example, a special file called "*P" (for printer) is opened and data is sent to the printer through the PUT statement, as if the printer were a disk file. There is also another special file "*T" (for terminal) that outputs to the terminal in the same way. This allows output to be directed to a disk file, the printer or the terminal with exactly the same program, depending only on which file has been opened.

Because of this file handling structure, a physical sector on a disk can be thought of as a print line. The PUT statement is followed by a list of variables to be output and they will be stored on the disk in the same format as they would appear if a PRINT statement had been used. To get the information off the disk, a GET statement followed by a list of variables is used. The GET statement has exactly the same structure as an INPUT statement. It differs from the input statement only in the way it sees delimiters, which are the characters that tell the system when one variable ends and another starts.

With Basic, several values may be entered using an INPUT statement by separating the values by commas. The comma is the delimiter. In the Micropolis version, the comma is the default delimiter, but the delimiter may be changed by defining it as any other character. This allows the input of strings with imbedded commas such as "city,state."

With disk access operations using the GET statement, a blank is assumed to be the delimiter for numeric values, because a blank is always output following a numeric value in a PRINT or PUT statement. However, in the case of strings, a delimiter must follow the string so the system will know when one string ends and another begins. Since the delimiter may assume any value that may be represented in 8 bits (even non-printable values such as hexadecimal value FF) strings of any length and containing any characters except the defined delimiter may be stored on disk and read back as needed.

Pointers set automatically

All Micropolis files are of the true random-access type, although they may be treated as sequential if desired. In the case of sequential access, if the record number is not specified in the PUT or GET statement, the record accessed is determined by PUT or GET pointers, respectively. When a file is first opened, the GET pointer is automatically set to the first record, and the PUT pointer is set to the last record plus one.

Subsequently, every time a PUT or GET is executed, the proper pointer is incremented by one, so the file may be read sequentially from the beginning and written with new records going to the end of the file. As an option, the PUT and GET pointers may be set under program control for flexibility in implementing more sophisticated file access schemes. In the case of random access, the desired record is simply specified in the PUT or GET statement and it is accessed without affecting the pointers.

The compact storage, relative low price and powerful features of this version of Basic make it an excellent choice for efficient computer operations. □

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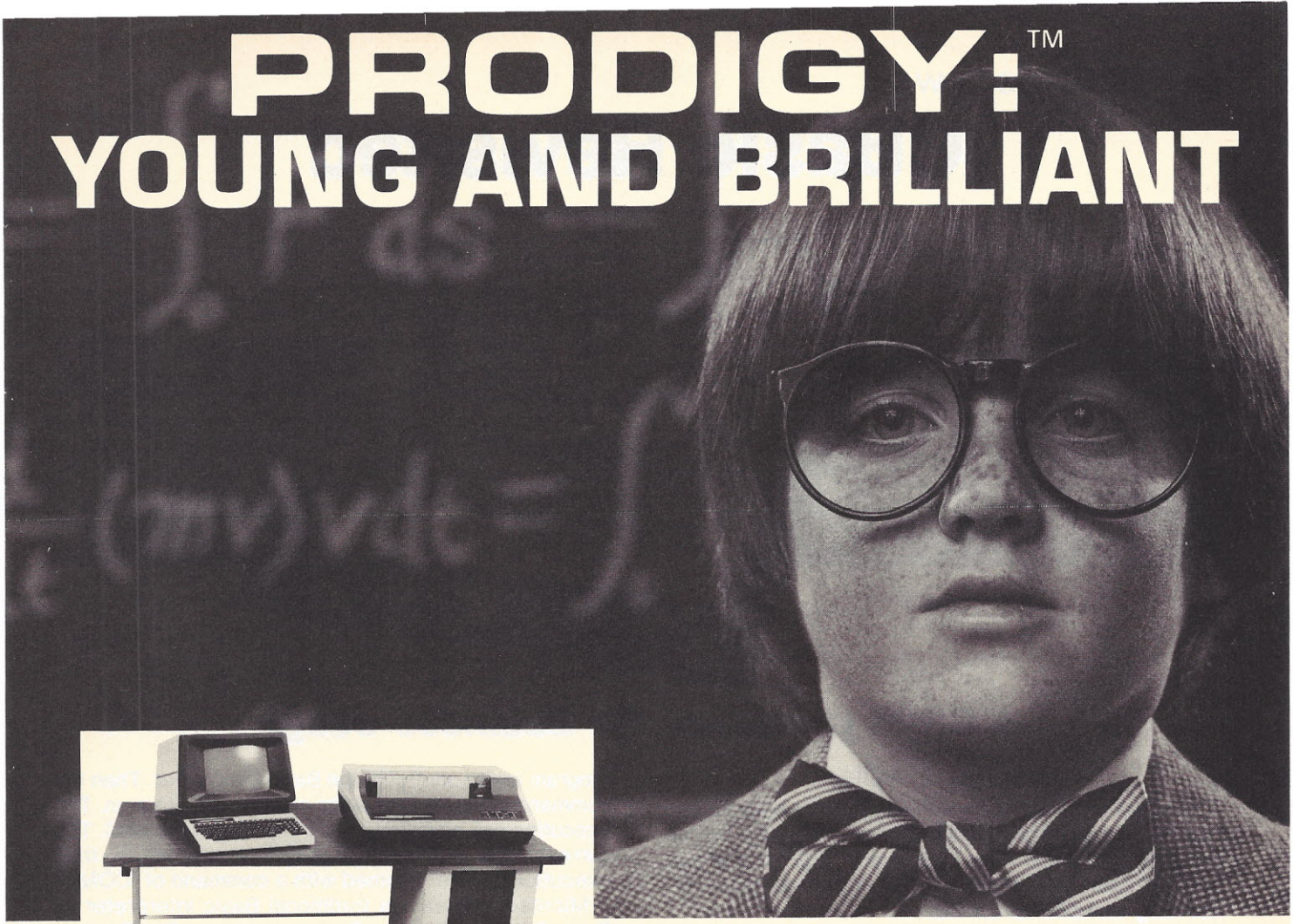

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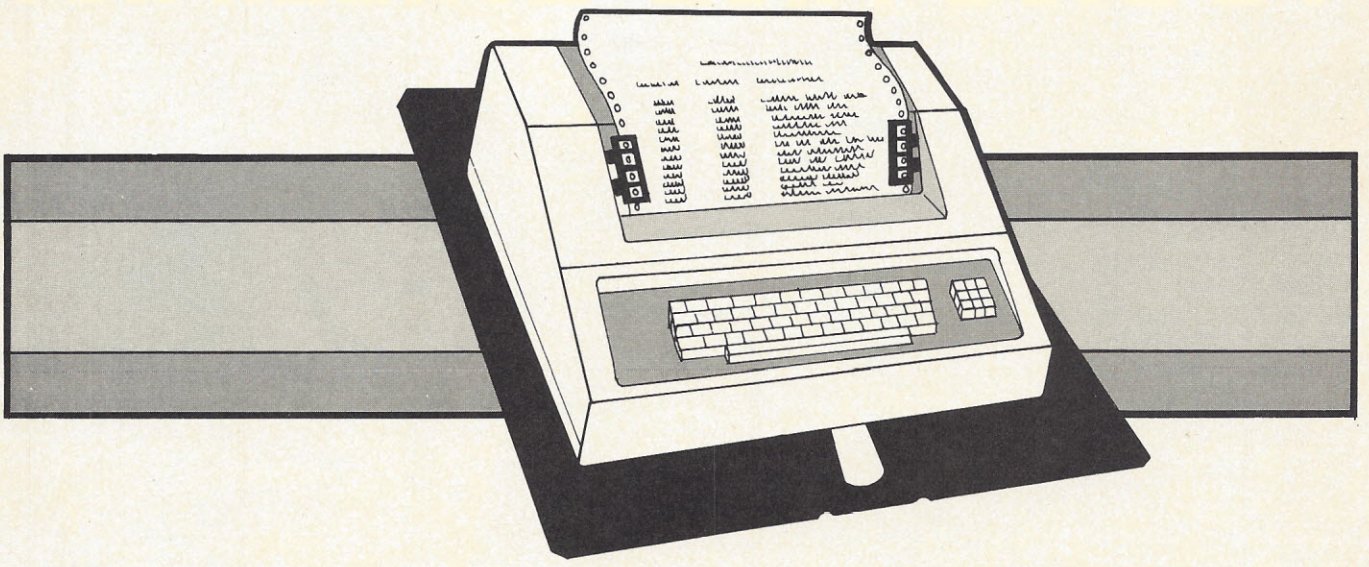
Software Review

CBasic Revisited



A CP/M Language for Business Usage

by Alan R. Miller

Are you satisfied with the computer language you now use for your business? Can you write the source program with a text editor such as WordStar or WordMaster? Can you easily revise your programs? Can you use long variable names like:

```
MONTHLY.PAYROLL(I%) and
WEEKLY.PAYROLL(J%)
```

for clarity of the resulting code? Do you have 14-digit precision and a dynamic range of 10 – 64 to 10 + 63? Can you easily manipulate strings of alphabetic and numeric (alphanumeric) characters? The answer to these questions is yes if you are using CBasic by Compiler Systems, Sierra Madre, CA.

CBasic (reviewed IA Aug 79) is a sophisticated version of Basic that runs under CP/M, MP/M and CPM/86 operating systems. Let's look at some major features of CBasic, then consider additional characteristics such as disk operations.

CBasic allows multiple statements per line as well as multiple lines per statement. Variables can be specifically typed as integer or string. Line numbers are only needed as labels for branching and there are constructions such as:

```
WHILE (logical expression is true)
  . . . (some statements)
WEND
```

and

```
IF (logical expression is true) THEN
  . . . (some statements)
ELSE
  . . . (some other statements)
```

But we're getting ahead of the story.

Basic is a high-level language that is usually implemented as an interpreter. The user enters the source program under control of the Basic interpreter. Then the command of 'RUN' is given to execute the program. The execution can be interrupted by typing a control-C. The current value of the variables can be printed out, then execution can be resumed with a command of 'CONT'.

Microsoft offers the traditional Basic interpreter as Basic-80. In addition, a Basic compiler called Bascom (IA Jul 80) is provided. In this case, the source program is written with the system editor. It is then compiled into a REL file with Bascom and finally converted into a binary COM file with the linking loader, L80.

The implementation of CBasic is similar to Bascom. Programming is accomplished in three stages. First, the source program is generated with a text editor (which is not supplied with CBasic). Second, the source program is compiled into an intermediate (INT) file. Third, the intermediate file is executed by a run-time monitor.

Since the monitor interprets the intermediate file, CBasic is sometimes described as an interpreter/compiler. With the usual Basic interpreter, there is a speed penalty for the use comments and long variable names. But this is not the case with CBasic. Comments are not transferred from the source file to the INT file. Variables, whether short or long, are converted into tokens in the INT file.

CBasic can be used like an ordinary Basic. For example, the following simple program will run on almost all Basics including CBasic.

```
10 REM FIRST BASIC PROGRAM
20 A$ = "### #### #.####^^^^ ##.####"
30 FOR I% = 1 TO 9
40   B = I%
50   PRINT USING A$; I%, B*B, 1/B, SQR(B)
60 NEXT I%
70 END
```

But by utilizing the unique features of CBasic, this same program can be written as:

```
  REM \
Second CBASIC program
  format$ = "### #### #.####^^^^ ##.####"
  FOR index% = 1 TO 9
    real.var = index%
    PRINT USING format$;  \
      index%, real.var * real.var,  \
      1.0 / real.var, SQR(real.var)
  NEXT index %
  END
```

The intermediate file and the resulting printout will be identical for either of these two programs. Several features of CBasic are evident in this second example. The absence of line numbers is the most striking.

Another feature is the free use of blank lines to set apart various portions of the program. Single statements, such as the PRINT USING in this example, can be spread over more than one line. The backslash character at the end of the line indicates that the statement is continued on the next line. (Notice, however, that Microsoft uses the backslash symbol to signify integer division instead.) Long variable names with embedded decimal points can be used to indicate the meaning of the variable. Lower-case letters can be used for variables and upper-case letters can be used for reversed words (or vice-versa).

When a line number is needed for branching, it may be any real number. Line numbers need not be in any particular order. Un-needed line numbers that might be left over from another version of a Basic program are flagged as a nonfatal error during the compiling step. Thus they can be easily located for removal.

As another example of a CBasic construction, consider the program shown in the following listing. Variable names are not declared at the beginning of the program as they are in Pascal or SBasic. The typing of integers with a % symbol and the typing of strings with a $ can be observed in the listing.

```
   REMARK \
  Simple guessing game to demonstrate SBASIC. \
  Computer picks a number, user tries to guess it.

    INPUT "Do you want to play a guessing game? "; answer$
    answer$ = LEFT$(UCASE$(answer$), 1)
    RANDOMIZE
    highest.number% = 100
    lowest.number% = 1

    WHILE (answer$ = "Y")
      computer.guess% = INT%(100 * RND)
      number.of.guesses% = 1
      PRINT "Guess a number from "; lowest.number%; \
            " to "; highest.number%;
      INPUT ":"; user.guess%

      WHILE (user.guess% <> computer.guess%)
        number.of.guesses% = number.of.guesses% + 1
        IF (user.guess% > computer.guess%) THEN \
          PRINT "Too high";\
        ELSE \
          PRINT "Too low";
        INPUT ", try again: "; user.guess%
      WEND

      PRINT user.guess%; " is correct"
      PRINT "Number of guesses was "; number.of.guesses%
      INPUT "Do you want to try again? "; answer$
      answer$ = LEFT$(UCASE$(answer$), 1)
    WEND

END
```

The UCASE$ function is another unique feature of CBasic. It converts all lower case letters in its string argument to upper case letters. Thus, in this example, it is not necessary to inspect the console input for the identifier ANSWER$ to distinguish between a lower case and upper case letter Y. Still another feature of CBasic is the randomize statement. This command is used to initialize the random number generator. Since the console keyboard response is utilized in this operation, it is necessary to give an input command prior to its use.

User-written functions are allowed in most Basics including CBasic. Thus the statement:

```
DEF fn.magnitude (a, b) = sqr(a*a + b*b)
```

placed near the beginning of the program defines the operation of taking the square root of the sum of the squares of two numbers. A later statement:

```
answer = fn.magnitude(first, second)
```

will call this function. The value of ANSWER will be the square root of the sum of squares of the variables FIRST and SECOND. Notice that the parameters A and B in the function definition are dummy variables. They are replaced by the actual variables when the function is called.

CBasic also allows multi-line user functions as well as one-line functions. For example, the function shown in the following listing can be used to determine the arctangent of the ratio of two numbers. It performs the same operation as the ATAN2 function in Fortran. There is a built-in ATN function in CBasic. But since it takes a single argument, it always returns an angle in the first or fourth quadrant (equivalent to a range of +90 and −90 degrees). Furthermore, the answer is expressed in radians rather than degrees. The function shown in the listing will place the result of the arctangent in the proper quadrant and convert the answer to radians.

```
DEF fn. arctan(y, x)

    IF (x = 0.0) THEN \
      answer = SGN(y) * 90.0 \
    ELSE \
      answer = ATN(y/x) * 180.0 / 3.1415926
    IF (x < 0.0) THEN \
      answer = answer + 180.0
    fn.answer = answer
  RETURN
FEND
```

The arguments X and Y are dummy variables, but ANSWER is a global variable. The angle whose tangent is A/B can be determined by the expression:

```
c = fn.arctan(a/b)
```

The result will appear in the variable C.

The dummy arguments are passed to the user-defined function by value rather than by location. Consequently, it is not possible for the function to change these arguments. That is, you cannot use a function like:

```
  DEF fn.swap(a, b)
      hold = a
      a = b
      b = hold
    RETURN
FEND
```

to interchange two values, such as X(I) and X(J) in a sorting routine.

CBasic has an extensive list of commands for handling disk files. New files can be created and existing files can be altered. The CBasic source program given in the following listing can be used to sort an existing disk file of string records. The original records are read into the array called RECORD. They are then sorted in increasing order with a Shell-Metzner routine. Finally, the ordered records are written to a new disk file. The names of both the original file and the new file are input from the console during operation. The UCASE$ command is used to insure that the filenames will be in upper-case letters.

Basic string arrays can contain elements that differ in length. That is, the first record might contain 80 characters, the second record might have only 10 characters, etc. However, CBasic cannot sort such an array properly if a straight comparison is made:

```
IF record (I%) < record(J3%) THEN ...
```

The program shown in the listing, however, takes care of this problem. After all of the records have been read from the original disk file, they are filled out (blocked) to the length of the longest record. The sorting routine puts the entire file into alphabetic order. The sorted array is then written to the new disk file.

If ASCII records are written to a disk file with a regular PRINT statement, each record will be enclosed with quotation marks. Alternately, a PRINT USING command can be used as demonstrated in the listing. In this case the string template for the PRINT USING command is an ampersand. This will write the string record without the quotation marks.

```
   REMARK \
Sort an ASCII disk file by blocking to longest record
   DIM record$(5))
   long% = 0
   max% = 550
   PRINT "Shell sort for string records"

60 PRINT
     INPUT "File to be sorted?; oldfile$
     oldfile$ = UCASE$(oldfile$) : REM convert to upper case
     INPUT "New filename?"; newfile$
     newfile$ = UCASE$(newfile$)
     OPEN oldfile$ AS 2
     L% = 0
160 IF END #2 THEN 230
      L% = L% + 1
      IF L% > max% THEN 210
        READ #2; LINE record$(L%)
        size% = LEN(record$(L%))
        IF (size% > long%) = size%
      GOTO 160
210 PRINT "Lines exceed dimension of "; max%
     GOTO 9999

230 nrow% = L%
     pad$ = 1 TO long%
       pad$ = pad$ + " "
     NEXT L%
        REM \
  pad out all records to length of longest record
     FOR L% = 1 TO nrow%
      record$(L%) = LEFT$(record$(L%) + pad$, long%)
     NEXT L%
     PRINT L%; " Records processed"
     GOSUB 3000 : REM sort the records
     CREATE newfile$ AS 1
     FOR L% = 1 TO nrow%
      PRINT USING "&"; #1; record$(L%)
     NEXT L%
     CLOSE 1 : CLOSE 2
     FOR L% = 1 TO nrow%
      PRINT record$(L%)
     NEXT L%
     GOTO 60

3000       REM \
      Shell-Metzner sort routine \
      Adapted from A. Miller, BASIC Programs \
      for Scientists and Engineers, Sybex, 1981
     jump% = nrow%
     WHILE jump% <> 0
      jump% = INT%(jump% / 2)
      J2% = nrow% - jump%
      J% = 1
      WHILE J% ⩽ J2%
       L% = J%
       WHILE L% > 0
        J3% = L% + jump%
        IF (record$(L%) ⩽ record$(J3%)) THEN 3150
          hold$ = record$(L%)
          record$(L%) = record$(J3%)
          record$(J3%) = hold$
          L% = L% - jump%
       WEND

3150   J% = J% + 1
      WEND
     WEND
    RETURN : REM for Shell sort

9999 END
```

Frequently used subroutines for such tasks as sorting or plotting do not have to be incorporated into each source program. It is only necessary to place a single copy into a separate disk file. Then when one of these routines is needed it is referenced with an INCLUDE directive. For example, suppose that a sorting subroutine is located in a file called SORT.BAS. The statement:

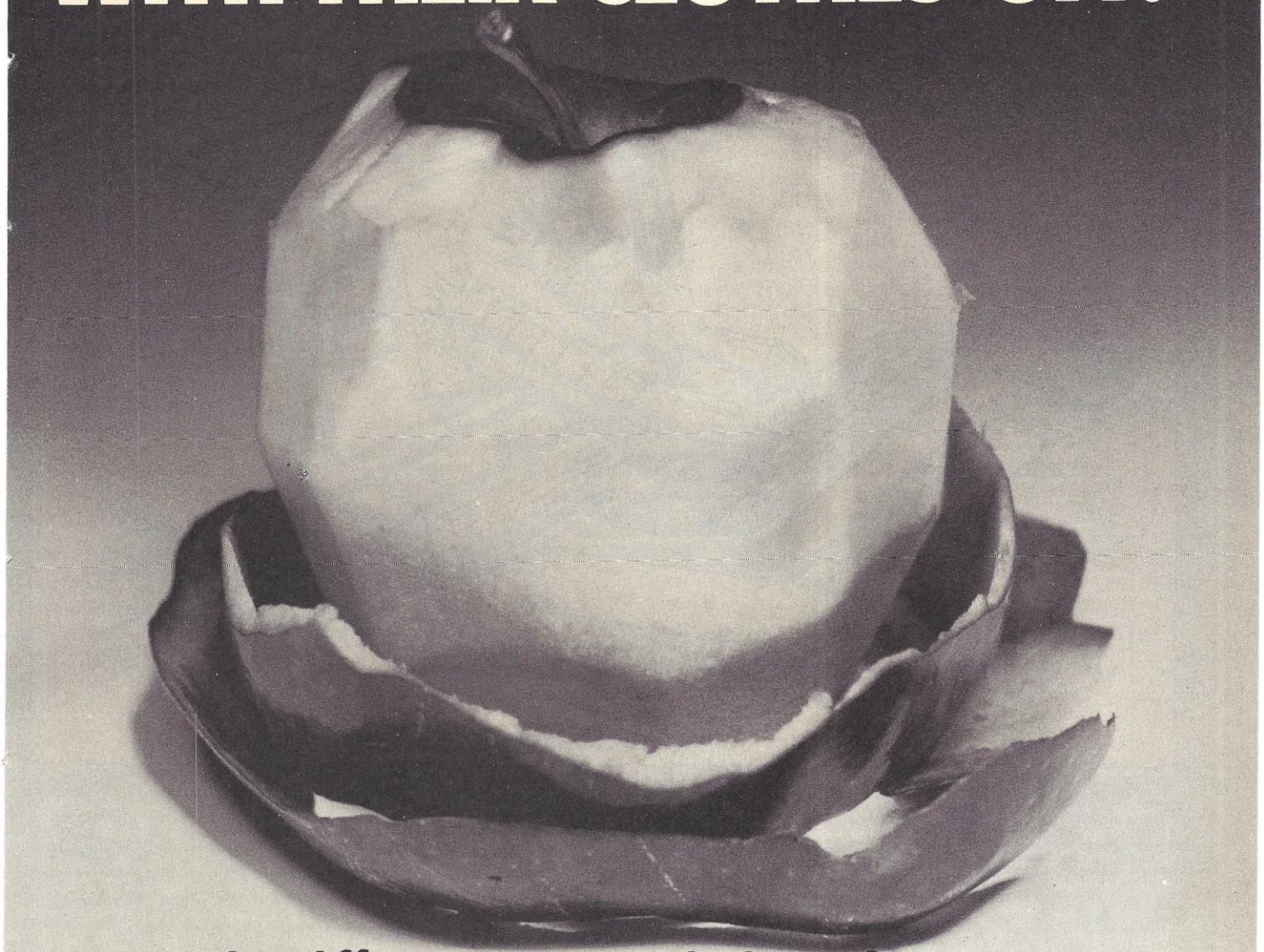
```
%INCLUDE B:SORT
```

is placed in the main program. When this statement is encountered during the compiling step, processing of the source program continues with the indicated disk file.

When the end of the INCLUDE file is reached, processing continues with the previous program. INCLUDE directives may be nested, that is, an INCLUDE file may itself contain an INCLUDE directive to another file.

There are many additional features of CBasic that have not been discussed, although they are also of interest. The main advantages are long-variable names, free form of the source program including multi-line statements, multi-statement lines, and general freedom from line numbers. In addition, easy string handling, and easy disk operations are welcome features. The programmer can begin with a regular Basic program, then alter it to take advantage of the many CBasic features. Alternatively, the unique style of CBasic is fairly easy to learn so that the programmer can learn to write directly in it. □

THEY ALL LOOK THE SAME WITH THEIR CLOTHES OFF.



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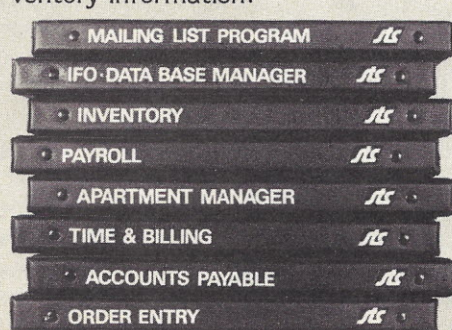

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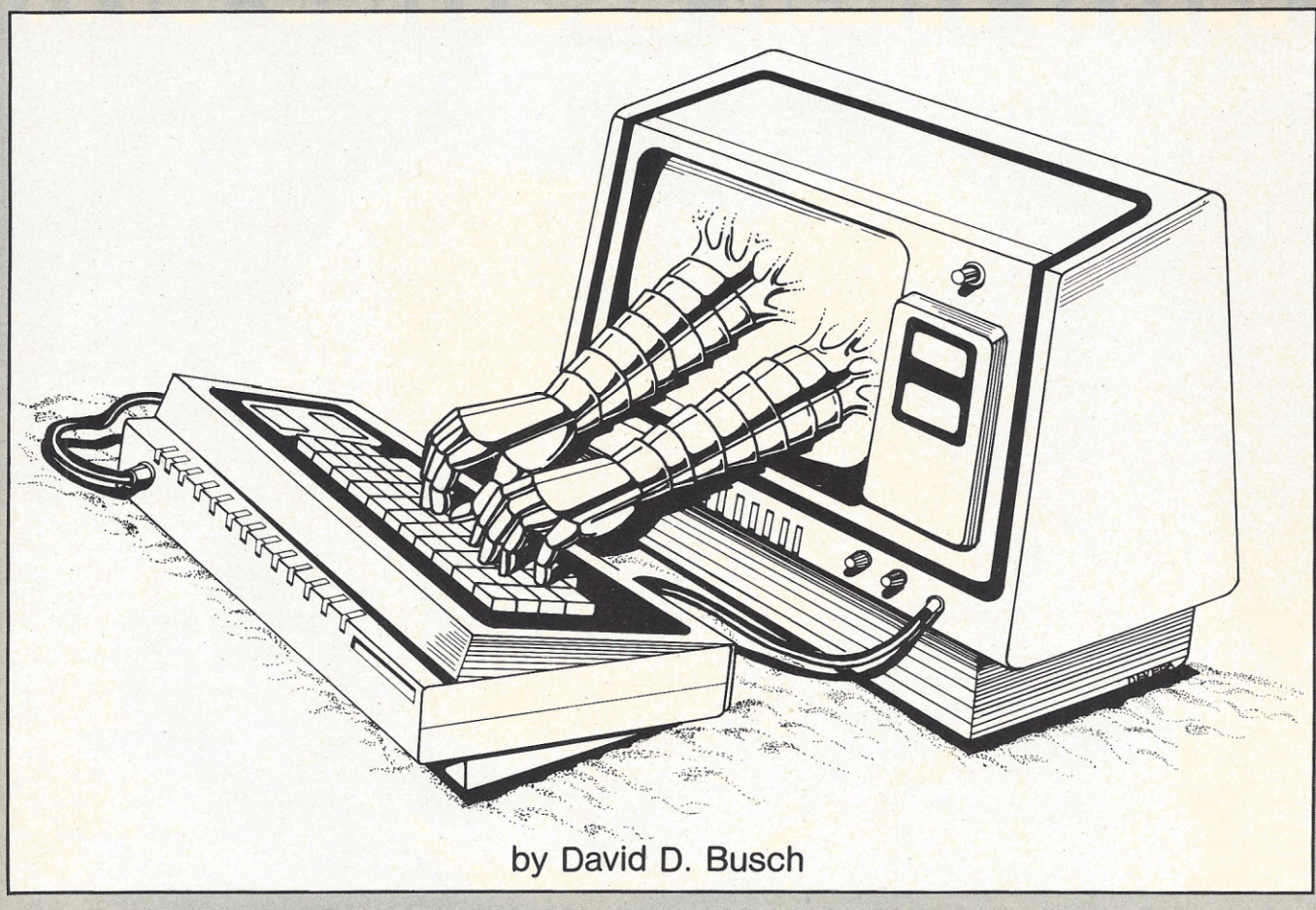

by David D. Busch

The following program, Instruction Writer, takes the computer aided-program design concept ("Let your Computer Write its Own Programs" IA Aug 81) one step further.

One of the difficulties of writing software is developing documentation. At one end of the spectrum is the simple, interactive, self-prompting program with multiple error traps that can be run by the unsophisticated user with no instruction at all. The other extreme is complex software (such as disk operating systems, compilers, etc.) that requires entire manuals or books to use properly.

Instruction Writer was intended for the broad range in between: those programs that require a few pages of quick instructions at the beginning of the program to make running the software a little simpler. The best part about this program is that it will format and page instructions automatically, write the necessary code, then append them onto the beginning of your Basic program.

Procedure for using the program is as follows:

1) Renumber your Basic program so that the starting line number is at least 100, preferably 200 or higher. This insures that your code will not overlap with the instructions tacked onto the beginning.
2) Save the program to disk in non-compressed, ASCII format. For the TRS-80 model I and model III, this entails adding a ",A" after the file specification. For example: SAVE "TARGET/BAS",A.
3) Load and RUN the program with a disk containing the target program in one of your disk drives.
4) Input instructions as desired. These may be typed in normally, with backspace used to rubout previous characters. However, a graphics block appears on the screen at the upper right corner. This block indicates the 50-character mark, which is the hot zone that approaches the right hand margin used in the instruction output. If a word ends within this zone, the program will automatically drop down to the next line. If you see that the word you are typing will extend more than three or four characters past the beginning of the hot zone, select an appropriate place for hyphenation, and insert a hyphen. The program will then recognize this character, and drop down a line at that point.
5) When all copy for instructions has been input, enter a & (ampersand). I chose this as a control character, but you can substitute any input character of your choice when modifying the program.
6) At this point, the program will create a group of directions—an instruction set, so to speak, from your input. These will be in proper program form. When complete, the instructions will be appended onto the target program you specified when Instruction Writer was RUN.
7) Line 1 of the new program should be deleted (it contains the MERGE instructions), and then it can

be RUN as desired. Several pages of instructions, developed to your specifications, will be displayed prior to the initial program lines of the original software.

The program works as follows: the user first specifies the name of the previously-stored-in-ASCII target program. This is input into a string variable, TP$. Next, a subroutine previously written and parsed is read into a string array, L$(n). This 10-line subroutine prints a graphic border around the screen of the TRS-80 model I or model III. The various portions of the routine are stored, minus line numbers, in data lines 250 and 260.

Next, a group of numbers (data line 270) is read into a second array, P$(n). These numbers correspond to six screen locations that will be used in PRINT @ routines to be created later. For example, the first item of data, 136, will be used to PRINT @ 136—either instructional material, or blanks to erase that portion of the screen without disturbing the graphics border around the edges.

At this point, the person running the program is urged to begin entering the instructional copy. The right margin hot zone is first placed on the screen (line 320). Eventually, this will scroll out of sight, but the other lines of copy will constitute sufficient reminder for most.

Entering instructional codes

An INKEY$ strobing loop in line 330 allows keyboard input of any character. When A$ does not equal null (""), control drops to line 340, where a check is made to see if the backspace character (CHR$(8)) has been entered. If so, the string storing the current input, B$, rubbed out from the right side one character.

If ENTER has been hit (CHR$(13)), control passes to line 420. Otherwise, unless the escape ampersand has been entered, A$ is added to B$, and A$ printed to the screen. If B$ is not greater than 50 characters, the program returns to the INKEY$ line for additional input.

When 50 characters have been entered, control always drops to line 410, where a check is made to see if a space (CHR$(32)) or a hyphen (CHR$(45)) have been entered. If not, the INKEY$ line is accessed once again for additional input.

When the length of B$ is more than 50 and a space or hyphen is recognized, B$ is stored in a string array, PROG$(n). Then B$ is nulled, and C, the PROG$(n) counter, is incremented by one, so that the next time that portion of the program is called, B$ will be deposited one element farther down in the array. This portion of the program is also used whenever ENTER is hit during the INKEY$ strobe.

Input may continue until "&" is entered. At this point, the last value of B$ is stored in PROG$(C) (line 480), and construction of the program subroutine begins. The program lines built are stored in a string array, LN$(n). The first and second elements of LN$(n) are defined in lines 510-520. Lines 3-13 are built within a FOR-NEXT loop. LN$(n) is made up of a string representation of the line number (STR$(N2 + 2)), a space, then one of the program elements read into the array L$(n).

The preceding steps build program lines that will 1) direct the MERGE, 2) clear the screen, and 3) print the graphics border to the screen.

Next, the program lines which print the instruction data to the screen are assembled. I chose to print only six lines per page. The user can change this by adding more PRINT @ locations to the data (520 and 584 would follow), and change the 6 in line 580 to a seven or eight, and the 5 in line 590 to a six or seven.

Nested FOR-NEXT loops construct the information pages. Because I used six lines per page, the outer loop goes from 1 to C STEP 6. The first inner loop determines which PRINT @ location will be used and builds the program line.

The first time through the outer loop, N3 will have a value of 1. Control will then go down to line 590, where N4 will be counted from 0 to 5.

At each increment of N4, the routine will first access a subroutine at 790, which increments the line number (LN) and makes the initial part of the line. For example,

```
1 MERGE "TEST":STOP:
     REM DELETE THIS LINE AFTER MERGER
2 CLS
3 FOR N=1 TO 63
4 PRINT @ N,CHR$(159);
5 NEXT N
6 FOR N=833 TO 895
7 PRINT @ N,CHR$(190);
8 NEXT N
9 FOR X=0 TO 41
10 SET(1,X)
11 SET(127,X)
12 NEXT X
13 PRINT @ 136,"  THIS PROGRAM WILL ALLOW YOU TO ENTER INSTRUCTIONS ";
14 PRINT @ 200,"FOR A BASIC PROGRAM OF YOUR CHOICE.  IT WILL AUTO-";
15 PRINT @ 264,"MATICALLY FORMAT THE DIRECTIONS INTO LINES OF APPROX-";
16 PRINT @ 328,"IMATELY 50 CHARACTERS EACH, AND APPEND THEM WITH THE ";
17 PRINT @ 392,"TARGET PROGRAM.";
18 PRINT @ 456,"  YOU NEED TO SAVE YOUR TARGET PROGRAM IN NON-COM-";
19 PRINT @ 714,"HIT ANY KEY TO CONTINUE";
20 IF INKEY$="" GOTO  20
21 PRINT @ 136,STRING$(55,32);
22 PRINT @ 200,STRING$(55,32);
23 PRINT @ 264,STRING$(55,32);
24 PRINT @ 328,STRING$(55,32);
25 PRINT @ 392,STRING$(55,32);
26 PRINT @ 456,STRING$(55,32);
27 PRINT @ 136,"PRESSED (ASCII) FORM, AND RENUMBER IT WITH LINE NUM-";
28 PRINT @ 200,"BERS HIGHER THAN 200.  IT IS ALSO NECESSARY FOR THE ";
29 PRINT @ 264,"USER TO ADD HYPHENS WHEN A WORD WILL EXTEND MORE THAN ";
30 PRINT @ 328,"A FEW CHARACTERS BEYOND THE GRAPHIC CHARACTER IN THE ";
31 PRINT @ 392,"UPPER RIGHT HAND CORNER OF THE SCREEN.";
32 PRINT @ 456,"";
33 PRINT @ 714,"HIT ANY KEY TO CONTINUE";
34 IF INKEY$="" GOTO  34
35 PRINT @ 136,STRING$(55,32);
36 PRINT @ 200,STRING$(55,32);
37 PRINT @ 264,STRING$(55,32);
38 PRINT @ 328,STRING$(55,32);
39 PRINT @ 392,STRING$(55,32);
40 PRINT @ 456,STRING$(55,32);
41 IF INKEY$=""GOTO  41
100 ************************************************
  *                                              *
  *               INSTRUCT/BAS                   *
  *                                              *
200              BY: DAVID D. BUSCH              *
  *                  515 E. HIGHLAND AVE.        *
  *                  RAVENNA, OHIO 44266         *
300                                              *
  ************************************************

400 CLEAR 8000
500 DIM L$(12),PROG$(100),LN$(100)
```

Figure 1. Example of program instructions created by INSTRUCT/BAS

if LN = 20, then LN$(LN) would equal STR$(LN) plus a space ("20"). Then, control RETURNS.

Now, LN$(LN) has appended to it "PRINT @", plus the next suitable PRINT @ location stored in P$(n). The first time through this inner loop, N4 will equal 0, so P$(0 + 1) will be used. The next time it will be P$(1 + 1), the P$(2 + 1), etc. Thereafter, a comma, and a quotation mark (CHR$(34)) will follow, and the first user-input instruction line will be added. The first time through both the outer and inner loop N3 will equal 1, and N4 0, so PROG$(1) will be used.

Then, the inner loop will repeat, adding PROG$(2) (1 + 1), PROG$(3) (1 + 2), etc., at each runthrough, until all six lines have been assembled.

When the outer loop is completed, N3 will be incremented by six, so that PROG$(7), PROG$(8), etc. will be combined on the next calling of the FOR-NEXT loop at line 590.

Each time the N4 loop is completed, control drops down to line 620, where a line on the order of "PRINT @ 714, "HIT ANY KEY TO CONTINUE" is constructed. Another, which makes an INKEY$ delay, is added. Then a set of lines that erase the previous page's output are built into lines 640-670.

Though a bit complex, this routine is quite effective in generating the needed program lines. This portion is the heart of the module.

All of these assembled program lines are written to a disk file, MERGER. This file is, in fact a runnable program, and the next step (line 770) is to RUN it. The resident program is erased from memory at this point, and replaced by the program just written, Merger.

Merger's first line performs the magic. It was assembled using the name of the target program, TP$, so that the line reads:

1 MERGE "TARGET/BAS"

or whatever filename originally input by the user. Since TARGET/BAS had been saved in ASCII form, and none of its line number conflict with those of Merger, the system will obediently append your program onto the instructions you have prepared. The final step is to delete line one, and save the new combined instructions/program under a suitable file name.

To illustrate this article, I used Instruction Writer to write a rudimentary set of instructions for itself. No sample run is included, because the run consists almost entirely of user input. Figure 1 is an example of instructions prepared by the program, merged with

```
    THIS PROGRAM WILL ALLOW YOU TO ENTER INSTRUCTIONS
FOR A BASIC PROGRAM OF YOUR CHOICE.  IT WILL AUTO-
MATICALLY FORMAT THE DIRECTIONS INTO LINES OF APPROX-
IMATELY 50 CHARACTERS EACH, AND APPEND THEM WITH THE
TARGET PROGRAM.
  YOU NEED TO SAVE YOUR TARGET PROGRAM IN NON-COM-


      HIT ANY KEY TO CONTINUE
```

```
PRESSED (ASCII) FORM, AND RENUMBER IT WITH LINE NUM-
BERS HIGHER THAN 200.  IT IS ALSO NECESSARY FOR THE
USER TO ADD HYPHENS WHEN A WORD WILL EXTEND MORE THAN
A FEW CHARACTERS BEYOND THE GRAPHIC CHARACTER IN THE
UPPER RIGHT HAND CORNER OF THE SCREEN.



      HIT ANY KEY TO CONTINUE
```

Figure 2. Sample screen output of instructions created by INSTRUCT/BAS for itself

Instruction Writer. Figure 2 is a representation of what appears on the screen of the CRT. The latter is an actual printout, produced by NEWDOS 80's JKL screen printing function. However, because my printer will not reproduce graphics, a dot border is shown instead. □

Program on page 156

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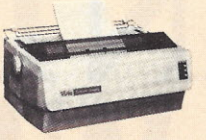

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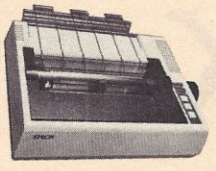

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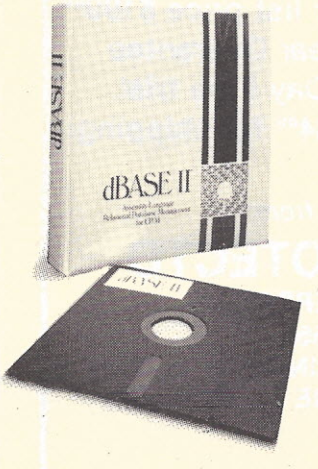

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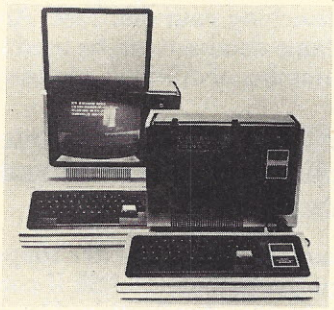

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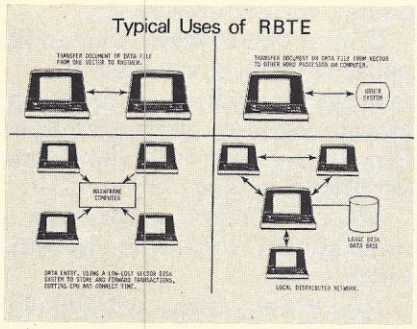

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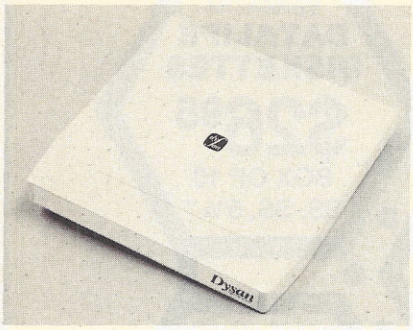
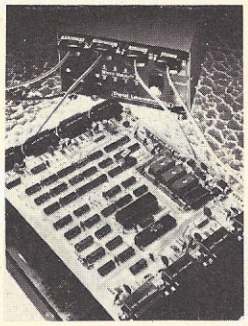


is typically 11-16M bytes unformatted. Weighing only 1.6 lbs., the Dysan disc cartridge is bit error-free, has two recording surfaces, and provides nominal recording densities of 6,858 bits per inch with 480 tracks per inch. Normal rotational speed is 3,600 RPM. Dysan Corp., 5440 Patrick Henry Dr., Santa Clara, CA 95050, (408) 988-3472.
CIRCLE INQUIRY NO. 230

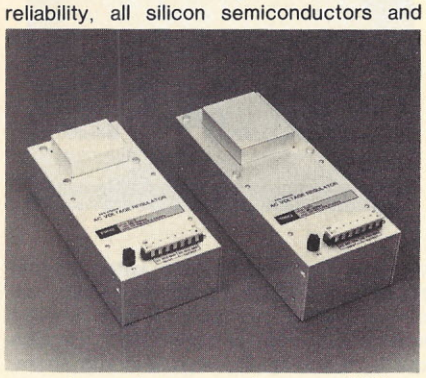
Universal data switch routes data in any direction within a mix of computers and peripherals under terminal or computer control. The Digital Micro-Matrix II is a Z-80-based, 8-port universal data switch that permits easy visual selection of any data transfer path within a network of up to 8 RS232C and/or current loop devices. Typically operated by a standard video terminal or under computer control, it stores up to 16 frequently used 8 by 8 connection matrices onboard, and needs no software modification or additional hardware. Featuring 2^{64} possible data paths, the Digital Micro-Matrix II provides more than 5K of ROM software, embedded in the unit and transparent to the user. The control channel handles any



standard baud rate from 110 to 9600; the other seven channels, any baud rate up to 9600. Ports can accommodate different

data rates simultaneously. Price: $995. Digital Laboratories, 600 Pleasant St., Watertown, MA 02172, (617) 924-1680.
CIRCLE INQUIRY NO. 231

AC voltage regulators correct short-term and long-term voltage fluctuations, feature energy-saving 96% efficiency, 8mS dynamic response, low distortion and compact size. Topaz regulators protect against brownouts, voltage sags and surges, transmission line voltage drops and intra-building voltage drops. OEM applications include use in communication systems, video and audio equipment, computer systems, medical monitoring systems, process controls and sensitive test instruments. Operating over a range of 47-63 Hz, models are available in power ratings of 1 kVA and 2 kVA. The regulators are compact and lightweight for ease in manufacturing. For increased reliability, all silicon semiconductors and



computer-grade components are used. Prices start at $375 for quantity purchases. Topaz, Inc., 3855 Ruffin Rd., San Diego, CA 92123, (714) 279-0111.
CIRCLE INQUIRY NO. 232

Bar code printers for producing bar code labels and tags via an integral keyboard/display, customer-supplied auxiliary CRT, or a simple computer protocol, are available in one of three standard print formats: 1) bar code with interpretation line; 2) bar code, interpretation line and one line of free text and 3) bar code, interpretation line and three lines of free text. The S series printers are offered for CODE 39 (9.4 characters per inch) or Codabar (at 10 cpi). The bar code symbols and human readable text are printed via a continuously rotating print drum that

produces printed bars with high optical contrast and sharply defined edges for maximum scanability. Specifically designed for on-site, random access bar code label preparation, the S series printers can print on adhesive paper labels, tags or high durability plastic label stock. For paper labels, a handy dispensing option "self strips" a completed label from its backing.

Price: from $5,945. Interface Mechanisms, Inc., P.O. Box N, Lynwood, WA 98036, (206) 743-7036.
CIRCLE INQUIRY NO. 233

Universal interface card is designed to be used in one I/O slot of SS-50C systems such as the SWTP 6809. The card may also be used in other standard SS-50 computer systems depending on mechanical clearance limitations in and around the rear of the I/O bus. The card allows the user to design custom I/O interfaces. Wire-wrap and hard-wiring may both be used in the design. Space has been provided for two ACIAs or a PIA chip, buffering and other logic the design requires. Provisions have been made for two subminiature D-type connectors and a ribbon cable header connector with up to 50 pins on a standard dual-25 pin connector located at the top edge of the card. The D connectors are mounted on the side of the card in a location for easy rear panel connection. The card supplies +5 volts DC with an on-card regulator with options for several filter capacitors. All I/O bus connections are provided at pads for easy user connection. Options are provided for baud rate and interrupt selection through DIP switches. External clock inputs are also provided. Price: $14. Quality Research Co., Box 7202, Spokane, WA 99207.
CIRCLE INQUIRY NO. 234

RAM expansion is possible with Power Pack cartridge, which plugs into the TRS-80 Color Computer's interface slot, providing 6K additional RAM and a powerful 2K monitor. The monitor provides the sophisticated programmer 33 powerful machine level commands and many utility routines. With its extra memory and routines in ROM, this device allows much more sophisticated software on cassette at much lower prices than the ROM packs currently available from Radio Shack. Also included is a free cassette of diagnostics for the color computer. Price: $159. Computerware, Box 668, 151 Encinitas Blvd., Encinitas, CA 92024, (714) 436-3512.
CIRCLE INQUIRY NO. 235

Desktop system, the ACI-1, features double density 8-in. drive and 65K of usable RAM. The Z-80 processor will run Digital Research CP/M 2.2 software and will interface various industry standard terminals, modems and printers via three RS-232 serial ports. A 2K monitor-in-ROM and disk utilities are provided to facilitate single drive operations, including

a multiple filecopy program that features ambiguous file specification. Also included in the 2K ROM are self-diagnostic programs. The compact 5.5H by 8.6W by 17.5D package is designed for cost-sensitive OEM and systems applications. Price: $1,995. Alspa Computer, 5215 Scotts Valley Dr., Scotts Valley, CA 95066, (408) 438-3326.
CIRCLE INQUIRY NO. 236

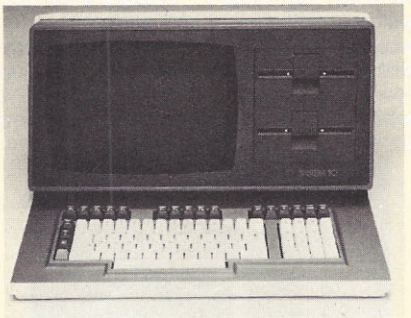
S-100 computer requires only a video display and media storage for operation. The Expander does not require a separate terminal, providing high speed operation. The computer is built around a single board that contains a Z-80A CPU, keyboard circuitry, interrupt, video circuitry, real time clock, parallel printer interface, RS-232 serial interface, and full color circuitry. Features include standard 80 by 24 screen format, upper/lower case, 4K ROM monitor, 64K RAM expandable to 512K, video output and color graphics using 256 colors, and a

complex tone generator with internal speaker. Keyboard capabilities include calculator keypad, two programmable function keys, and four cursor control keys. The high quality typewriter-like keyboard lets secretaries feel right at home. The Expander is quite versatile. It functions well as a process

control system, a monitoring system, for data communications, or other applications that do not require a video display. It has room, however, for several S-100 boards so the computer can be configured to perform word processing, high resolution color graphics, and numerous business applications. All CP/M and MP/M software written for the Z-80 will run on the Expander, as well as any other Z-80 operating system. In addition, the comptuer will run Fortran, Cobol, APL, ALGOL, C and other languages that run under CP/M. Price: $2,200. Micro-Expander, 6835 W. Higgins Ave., Chicago, IL 60656, (312) 792-1196.

CIRCLE INQUIRY NO. 237

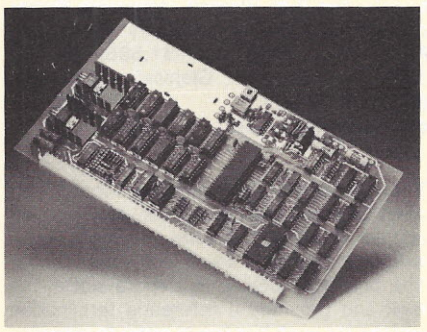
Z-80 based computer will run most software packages under CP/M version 2.2. The System 10 is a solution oriented product utilizing state-of-the-art microcomputer technology and a wide variety of applications software. With the flexibility of software and communications, growth into distributed processing is now within the financial range of any small business or accounting department. The integration of keyboard, CRT and



700K storage on two (DSDD) mini drives is an attractive alternative for the professional user who appreciates the cost and the aesthetic value as well. Standard features include: 65K RAM, 700K storage on dual floppies, two RS-232 ports, an IEEE-488 and an RS-449 port, and a (high-speed parallel port) hard disk interface. Price: $5,950. Data Wholesale Corp., 700 Whitney St., San Leandro, CA 94577, (415) 638-1206.

CIRCLE INQUIRY NO. 238

Color video display generator/controller is for System-50 (SS-50, SS-50C) 680X computers. The Colorama card, permits software selection of any of 11 different display formats, including eight-color semi-



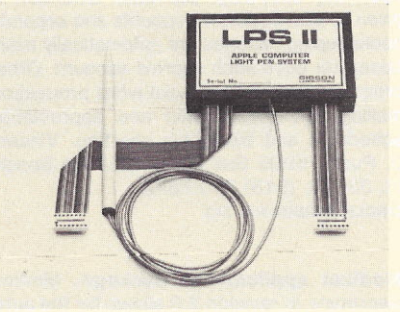
graphics, two- and four-color graphics and two-color alphanumerics. Two- and four-color displays may also be switched between primary and complementary color sets, either under software control or from the keyboard. Resolution of full-graphic displays ranges from 64 by 64 picture elements (pixels) to 256 by 192 pixels. All 64 characters of the standard ASCII character subset are generated by the on-card character generator. Price: $219.95 configured with 1K byte of display RAM. Percom Data Co., 211 N. Kirby, Garland, TX 75042, (214) 272-3421.

CIRCLE INQUIRY NO. 239

Color computer is new version of CBM 8032 model. The standard CBM 8032 features a 12-in. (80 by 25) display. 73-key typewriter style keyboard with standard upper/lower case, numeric keypad and full cursor control. The computer contains a high-resolution, direct drive RGB (red, green, blue) color monitor that provides a crisp, easy-to-read display in both text (same 80 by 25) and graphic modes. Users will be able to run all software developed for the standard CBM 8032 on the color version without modification. Color displays can be generated on a character by character basis, either directly by the user, or under program control from within a single print statement. In all, there are 8 colors available (black, blue, green, cyan, red, magenta, yellow, and white) for both the background color and foreground display, resulting in 64 possible combinations in each of three character modes (TEXT, GRAPHIC and PLOT). Commodore Business Machines, 681 Moore Rd., King of Prussia, PA 19406, (215) 337-7100.

CIRCLE INQUIRY NO. 240

Light pen system with full 280 by 192 Apple hi-res resolution is now available for use with Apple II computers. With the light pen, hi-resolution graphic information can be



entered through the screen of the Apple computer. Applications include computer-aided design, menu-selection, business graphics, computer-aided drafting/architecture, circuit analysis, interactive education, word processing, untrained-operator operation and game playing. Gibson Laboratories, Bldg. 10, 406 Orange Blossom, Irvine, CA 92714.

CIRCLE INQUIRY NO. 241

Position-sensing peripheral indicates the position of objects in its field of view to unusually high resolution. The Op-Eye device detects and indicates the position of reflective or self-luminous objects when used as a peripheral for the Apple II computer. In contrast to the lower resolution of conventional video digitizers, the device has a high resolution of typically 1 part in 4,000 across the detector surface in both X and Y directions. With appropriate optics, displacements of less than 0.0001 in. can be measured. Further, the unit is a high-speed device with a better than 5 kHz information rate. Uses include monitoring machine position, angle sensing, small part detection, shaft encoding,

large area graphics digitization, bio-engineering, profilometry, vibration analysis, stress monitoring and automatic QC of parts.

The complete unit (less Apple II) is priced at $1,550. United Detector Technology, 3939 Landmark St., Culver City, CA 90230, (213) 204-2250.
CIRCLE INQUIRY NO. 242

Accounting system, Real-Tabs, written in North Star Basic, is a software package available for real estate and management brokers, attorneys, title companies, mortgage brokers and other business entities. The programs operate in a real-time mode, making it possible to obtain all manner of to-date reports (printed or viewed) at the end of each business day. Payroll is fully supported along with summary reports for year-to-date and for any specified time period. A data base management system is included, which provides for profitable managerial control. Ordered files provide instant retrieval of the business history and identity of any client or customer. In addition to the usual business operating accounts, particular attention is given to client escrow accounts and separate bookkeeping histories are automatically maintained for each such escrow account. Other programs include a special word processor, mailing list, amortization and depreciation schedules and biorhythm charting. Vincent D. Puzar, 5905 Gulf Blvd., St. Pete Beach, FL 33706, (813) 360-7577.
CIRCLE INQUIRY NO. 243

Medical applications package, Medical Secretary, in revision 2.0 allows for the automation of appointment scheduling, private patient billing, insurance form preparation, medical history and patient record maintenance and word processing. The latest release adds many features to the Medical Records maintenance system such as extended record lengths, improved editing, global diagnostic search, record reformatting, recent records review, and patient form letter preparation. The system also offers improved handling of specialist's medical reports, summary medical record preparation, and form preparation of referral letters. The package is designed to operate on the Apple II or Apple II Plus computers with 48K of RAM and Applesoft in ROM or Apple III computers with at least 96K of RAM. The systems require two disk drives and a 130 column printer. Price: $700. Monument Computer Service, Village Data Center, P.O. Box 603, Joshua Tree, CA (800) 854-0561, ext. 802.
CIRCLE INQUIRY NO. 244

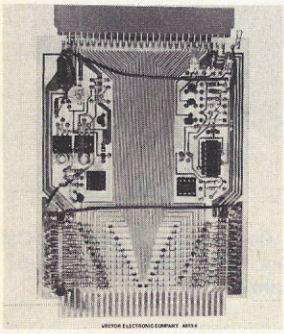
Full compiler system for North Star Basic is available for all double or quad density North Star systems. The Comstar compiler translates a North Star type 2 file into an assembly language program and thence into a fully operational machine language program. The resulting programs run faster than their Basic equivalents and as machine code fully protect the original source Basic program. The only major restrictions imposed on the program to be compiled are that variable dimensions and disk file numbers must be decimal constants. Available for double or quad density systems only, neither the compiler nor the compiled programs will read or write single density disks. A dual drive disk system is desirable, and mandatory for large Basic programs. The compiler consumes approximately 12K memory with additional space required for data storage. Programs generated by Comstar perform all their I/O through the North Star DOS. The compiler is available for DOS located at either 100H or 2000H. Either version can generate programs for any DOS location. Price: $400. Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107, (213) 793-5748.
CIRCLE INQUIRY NO. 245

Computer housing holds drives and display. A cast-urethane and sheet metal housing, the Super Card Cage V1, includes a four-slot Multibus motherboard and ample space for mounting two Shugart-compatible 8-in. floppy disk drives, a video monitor, and a switching power supply. The package includes a separate keyboard enclosure. The housing comes predrilled for a fan, connectors, fuse,

power cord, and power on switch. Optional configurations accommodate up to six Multibus cards or a six-slot S-100 bus, an eight-slot Q-bus or twelve-slot STD-bus motherboards. A second version, the Super Card Cage V2, includes all the necessary internal wiring, a 150 watt switching power supply, a 12-in. black and white monitor and a detached 77 key ASCII decoded keyboard. The OEM or system integrator adds his own system boards, two 8-in. Shugart compatible floppy disk drives and any necessary I/O cables. Prices: V1—$495; V2—$1,565. Psytek, 1900 Pickwick Ave., Glenview, IL 60025, (312) 729-3200.
CIRCLE INQUIRY NO. 246

Terminator board for ProLog, Mostek and other STD bus etched systems, incorporates additional etched circuits to serve as a shielded extender board and logic probe. The board is installed in a spare slot in the rack and provides a reference termination voltage for each bus line in order to minimize cross talk, ringing and transients. When trouble-shooting is required, logic or memory boards are inserted in the extender socket and tested using self-contained logic-probe circuits. The model 4610-6 terminator/extender is form and functionally compatible with STD cards and has the female receptacle

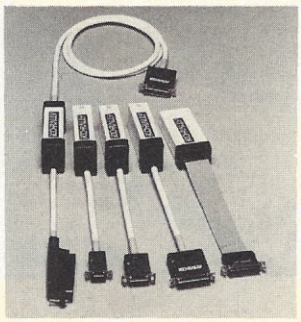
installed. A second version, the model 4610-6B, has provisions for installing a flat cable extension to a remote receptacle. Each of the 56 bus lines are separated by a grounded line, providing a Faraday shield which further reduces cross talk. Both boards include printed wiring for active-termination and logic-probe circuits; com-



ponents are commonly available and are not supplied. A clearly-labeled legend designates component locations for easy installation. Instructions, parts lists, circuit diagram and component layout are given in the instruction sheet. Prices: 4610-6—$59; 4610-6B—$50. Vector Electronic Co., 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661.

CIRCLE INQUIRY NO. 247

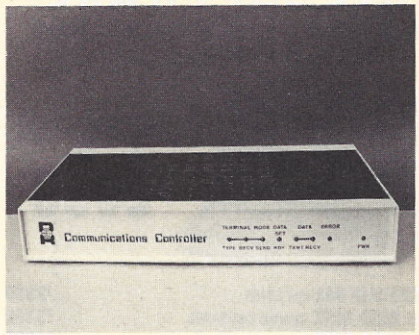
Programmable computer cables allow the end user to program two components to meet specific interconnect requirements. With the Match Box system, the end user buys two cable components, one of the required cable length and compatible with interconnect requirements. The cable key, when attached, programs the specific interconnections as dictated by the needs of the system. The entire assembly can be completed typically within five minutes, according



to the company. This on-the-spot assembly of the two components reduces delay in original installations and facilitates additions and relocations of peripheral equipment. ICO-Rally Corp., 2575 E. Bayshore Rd., Palo Alto, CA 94303, (415) 856-9900.

CIRCLE INQUIRY NO. 248

Mainframe interface in a combined hardware/software package enables Pet microcomputers to be connected to mainframes and act as full facility interactive terminals. The system comprises a communications control box and software that controls both it and the Pet when running in the communications mode. The box, which connects directly to the Pet user port, is microprocessor controlled. Memory is provided to house the protocol handling routines, which are both resident in ROM and downloaded from the Pet, and also act as a receive and transmit buffer. Output from the control box

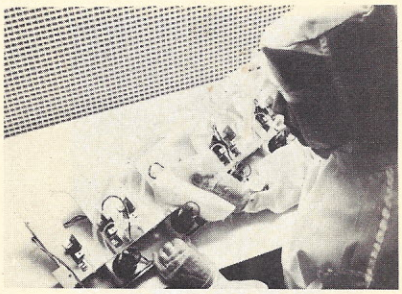


is via an RS232C interface, enabling communication with the host mainframe by direct line or telephone modem. Efficient handling techniques allow several terminals (whether Pet based or not) to share a single line depending upon its capacity and quality. The system is available to support ICL C01 and C02 protocols, and emulate ICL 7181, 7501, 7502 and IBM 3780 and 3270 workstations. Data transmission speeds in the range 1200 to 9600 baud are available as selectable options, but other speeds can be obtained. Davidson-Richards Ltd., 14 Duffield Rd., Derby DE1 3BB, England, telephone (0332) 366803.

CIRCLE INQUIRY NO. 249

High technology wiper, Techni-Cloth is for critical applications where advanced technology requires more stringent standards for contamination control. Combining the absorbency of cellulose with the strength of polyester, the construction is free of contaminating binders and additives. This

eliminates the residue that ordinary wipers generate during use. Sizes and prices: TX609, 9-in. by 9-in. (300/box)—$24;

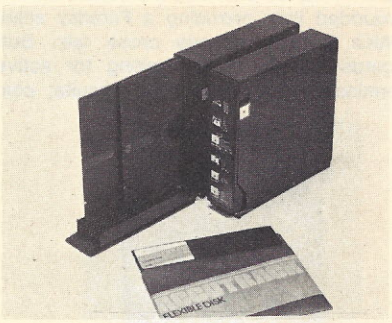


TX612, 12-in. by 12-in. (150/box)—$24; and TX608, 8-in. by 4-in. (100/box) 20 box/case —$75. Texwipe, Box 575, Upper Saddle River, NJ 07458.
CIRCLE INQUIRY NO. 250

Universal micro desk accommodates the S-100 type microcomputers. It is designed with an optimal height of 27 in. for both typing and working. The vented bay enclosure can be mounted on either the right or the left side and features two sets of adjustable support bars for a custom fit of the S-100 computer. The desk will fit such popular computers as the Altos, Cromemco, Dynabyte, North Star and many others. The desk is available in four sizes: 17.75-in., 19.06-in. and 20.75-in. wide openings with 24-in. front to rear mounting space. The fourth size is a 20.75-in. wide opening with a 26.50-in.

front-to-rear mounting space. These sizes allow for a precise fit for the computer with support bars being adjustable at one inch increments. The desk is constructed of high pressure laminate tops, heavy gauge folded sheet metal, and welded tubular steel for maximum strength and support of the computer system. The desk comes complete with a set of casters. The colors available for the top are teak, walnut, champagne and white. The sheetmetal is finished in black or champagne textured baked enamel. Electronic Systems Furniture, 17129 S. Kingsview Ave., Carson, CA 90746, (213) 538-9601.
CIRCLE INQUIRY NO. 251

Diskette magazine is compatible with IBM series 1 System/34 and System/38 computers. The magazine holds ten 8-in. flexible disks for use on IBM systems with auto-load diskette drives. Each magazine can store up to 16M bytes unformatted and over 10M bytes formatted. The magazine in combination with the drive works much like a juke box, selecting the desired disk and loading it for operation. In addition to reduced operator handling and increased system throughput, the magazine serves as a protective storage compartment when the disks are not in use.



Price: $58. Dennison KYBE Corp., 82 Calvary St., Waltham, MA 02254, (800) 225-8715.
CIRCLE INQUIRY NO. 252

Tactical space battle game, Invasion Orion, lets the player control up to nine space ships armed with destructor beams, tractor beams, missiles and torpedos, against the computer. Each ship spends energy on moving, shielding itself and on firing its weapons. The player must decide how to best allocate that energy to defeat his opponent. The game comes with Battle Manual, game program, and 10 pre-created scenarios. A special supplement program, also included, lets the player create more scenarios of his own, and even design his own ships. The game is available on cassette for the Atari 800 with 32K RAM. Price: $24.95. Automated Simulations, Box 4247, Mountain View, CA 94040.
CIRCLE INQUIRY NO. 253

Four interactive games for TRS-80 include the following: Gin Rummy 3.0, with color card graphics and sound, plays a full regulation game of Gin, and can hold its own against even skilled players. Casino Blackjack/Counter is a very realistic simulation of playing at a casino table—card graphics show five hands dealt, and the user plays the center hand while the computer plays the rest. Labyrinth Run is a fascinating/frustrating test of skill and coordination, uses the joystick to guide a fast-moving runner through twists, turns, reverses and slaloms, with thunderous crashes when the runner hits a wall. Concentration, with full-color clever graphic symbols on the screen, is a fun-to-play computer version of the classic match-the-card game. Manhattan Software, Box 35, Pacific Palisades, CA 90272, (213) 454-8290.
CIRCLE INQUIRY NO. 254

Record-keeping software, DataStar, for the Z-89 microcomputer permits the easy design of records or forms for others to use to enter information. The records or forms can include instructions and can even check the validity of data being entered. The automatic calculation feature permits the easy preparation of reports for scientific, financial or accounting applications. The software also has a file manager which searches records and retrieves the information needed for editing or updating. The program can be used to create data files for use in other programs. It is compatible with most languages supported under the CP/M operating system, including Basic Fortran and Cobol. Price: $295. Zenith Data Systems,

1000 Milwaukee Ave., Glenview, IL 60025, (312) 391-8181.
CIRCLE INQUIRY NO. 255

Video game, Freeway, features eight different games with variations of ten lanes of traffic—from a few scattered cars moving

slowly, to high speed, bumper-to-bumper cars and trucks. The player uses the joystick controller to maneuver a chicken from one side of the freeway to the other. Each successful crossing scores a point. The game may be played by one or two players at once. Another game, Kaboom, features a "Mad Bomber", a meticulously animated cartoon convict, complete with a mask and a variety of facial expressions. He roams back and forth across the top of the television screen dropping black bombs with lit fuses. The player controls a group of three water buckets with a paddle controller and must catch the bombs as they fall, thus dousing the fuses. Each bomb caught adds to the player's point total. When a bomb is missed, all bombs on the screen explode, and the player loses one of his water buckets. When all buckets are gone, the game is over. The game has one-player and two-player variations. Price: $22.95. Activision, Inc., 3255-2 Scott Blvd., Santa Clara, CA 95051, (408) 727-7770.
CIRCLE INQUIRY NO. 256

Portfolio management system for the Commodore Business Machines line of microcomputers provides the private or professional investor immediate access to pricing and financial information available through the facilities of the Dow Jones News Retrieval Service and additionally functions as an accounting and control system for security portfolios. The system allows maintenance of stock portfolios, automatic valuation of positions in the portfolio retrieval of current and historical quotes and displaying/printing of news stories from the previous 90 days. The PMS runs on the Commodore Pet model 2001 microcomputer with 32K memory, the Commodore model 4032 or Commodore model 8032 microcomputer. A Commodore model 4040 or 8050 dual disk drive and a modem are required for operation. Price: $150. Commodore Business Machines, 681 Moore Rd., King of Prussia, PA 19406, (215) 337-7100.
CIRCLE INQUIRY NO. 257

Microprocessor development systems enable any TRS-80 model I or model III computer with at least 32K RAM to serve as a software development station for a wide variety of single-chip processors. Processors covered by the series of TRS-80-compatible assemblers are the Intel 8048 family, the RCA Cosmac 1802/1804, the National COP400 series, the Zilog Z-8, the AMI S2000 series, and the Fairchild/Mostek 3870. Each of the development systems is a unified assembler/editor. As a group, the development systems share a common operational structure, with uniform procedures for program entry, modification, assembly, and source file handling. With minor exceptions, the assemblers feature instruction mnemonics and syntax as defined by the processor manufacturers. Source files can be saved on tape or disk. Price: $75 on TRS-80 cassette, or mod III diskette. Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107, (213) 793-5748.
CIRCLE INQUIRY NO. 258

Conflict program shows disk area status of CP/M files. It is a natural companion program to the earlier released Unera program which allows an erased file to be recovered. When recovering an erased file on a disk that has been written to, there is the possibility that the same disk space is now used by more than one file. This means that by unerasing one file another file may be ruined. The Conflict program goes through the directory and reports to the console or to the printer any conflicts that may exist for the same disk space. The program checks every file in the directory (that includes erased files as well as active files) and shows what files conflict. The Conflict program works on both multi-disk and single disk systems that use a standard CP/M disk directory. Printed instructions are included with each diskette. Conflict.Com is available in either 8-in. standard CP/M format or 5¼-in. for North Star CP/M users. Price: $35 plus $1.50 shipping and handling. Price for Unera and Conflict ordered at the same time is $60 plus $1.50 for shipping and handling. Elliam Assoc., 24000 Bessemer St., Woodland Hills, CA 91367.
CIRCLE INQUIRY NO. 259

Graphics program is designed to help software OEMs and private software developers prepare computer programs that require generating three-dimensional and two-dimensional grpahics. The program enables Apple II and Apple II Plus users to see a multidimensional object from any angle. Programs developed using AppleGraphics II can be used by architects to design buildings, by drafting professionals to prepare plans and scientists to conduct experiments. System requirements are an Apple II or Apple II Plus computer with 48K bytes of memory, Apple Language system, a video display unit and a disk drive. The addition of a plotter adds hard copy capability to the system. Price: $95. Apple Computer, 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.
CIRCLE INQUIRY NO. 260

Communications software package for the TRS-80 model II allows it to operate with two types of IBM terminal equipment used for on-line communications or for batch-processing. The software package offers not only the utility of an IBM-compatible terminal, but the computing power of the model II and its substantial software support as well, including business programs like Scripsit and VisiCalc, plus languages like compiler Basic, Cobol, Fortran and Z-80 editor/assembler. The package allows the computer to fully implement binary synchronous communications in full conformance to IBM standards. The package includes both the software necessary to implement

the communication protocols and code conversions, and a hardware conversion that modifies the modle II A serial port to meet the requirements of these standards. Price: $995—(catalog number 26-4715). Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

CIRCLE INQUIRY NO. 261

Statistical software, Statistics 3.0, provides teachers, university students, and scientific and technical professionals with the means to quantify and evaluate mathematical relationships. The system affords maximum user control. Direct access to slot-controlled printer allows hard-copy printout. For the Apple and II-plus computers. Price: $29.95. Edu-Ware Services, Inc., 22222 Sherman Way, Suite 102, Canoga Park, CA 91303.

CIRCLE INQUIRY NO. 262

Medical billing system prepares patient bills and insurance claims, including Medicare and MediCal, for single or multiple doctor offices. Accounts receivable are maintained by patient and insurance carrier, and transaction detail is retained to permit tracking of individual claims. SoftCare accounts for partial payment of claims, write-offs, and secondary insurance carriers. The design requires little or no operator training. The software guides the operator and does error checking as information is being entered. Moving from one function to another can be done at any time, from anywhere on the screen, using function keys shown on the screen. The program is written in UCSD Pascal, runs on the Apple II with 8-in. diskette drives or the Corvus hard disk. Price: $1,995. Professional Business Software, 119 Fremont St., San Francisco, CA 94105, (415) 546-1596.

CIRCLE INQUIRY NO. 263

Accounts receivable system is written in Basic for the TRS-80 model II and requires a 132 column printer. There are three versions of Orders, one of which will operate on a single drive system. All systems operate under TRSDOS and do not require any additional operating system. The system will create invoices, update inventory and generate transactions that update the accounts receivable module. Version 1 operates on a single drive. Version 2 is multi-drive system that allows up to 4,000 inventory items. Version 3 is a manufacturing system that has a bill of materials for each finished product and updates the raw materials inventory from the bill of materials. All versions produce invoices, update inventory, produce price lists, inventory lists, reorder reports, customer sales history, open items accounts receivable reports, open items aging, closed items listing, monthly statements and customer listings. All data is directly addressed and may be quickly displayed. Interface to NSM's General Ledger is also available. Price: $275 for any version. Dr. Elliot B. Kleiman, National Software Marketing, Box 6195, Hollywood, FL 33021.

CIRCLE INQUIRY NO. 264

Billing system for one to ten physicians on the Apple II Plus handles 7,000 accounts and 2,000 transactions per billing period. Medicare, Medicaid, Medi-Cal, and Blue Cross forms are filled out at the touch of a key. The insurance companies can be billed

BETA COMPUTER DEVICES

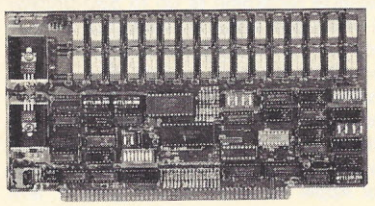
FEATURE PRODUCT

ADDS VIEWPOINT TERMINAL

$629.00

- Detachable keyboard weighs only 2 lbs.
- 110-19,200 Baud - RS-232C
- Cursor control keys - audible tone
- 24 x 80 characters - 12" screen
- 14 key numeric keypad
- 7 switch selectable character sets
- Addressable cursor
- 2 position screen tilt
- Normal or reverse video
- Half or zero intensity
- 3 function keys (six functions)
- Lightweight (22 lbs. with keyboard)
- Switch select block or underline cursor
- Switch select blinking or steady cursor

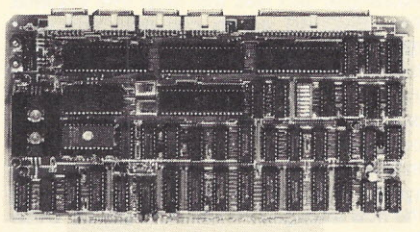
S-100 PRODUCTS



QUALITY RAM FROM SYSTEMS GROUP

- Z-80 4MHZ operation with no wait states
- IEEE compatible timing - 200 NS 4116's
- Factory assembled, tested & burned in

DMB6400 64K (Bank Select, shown).....$749.00
DM6400 64K 545.00
DM4800 48K..... 520.00
DM3200 32K..... 495.00



CONFIGURE A COMPLETE S-100 SYSTEM WITH 2nd GENERATION* PRODUCTS FROM SYSTEMS GROUP.

- CPC 2810 (shown) Z-80A processor board (4MHZ) with 4 serial & 2 parallel ports.....$369.00
- CPC2813 - same as CPC2810 but 2 serial ports only.....$345.00
- FDC2801/8 - 8" floppy disk controller board, up to 4 single/double sided drives, single or double density.....$349.00
- INO-2804 - 4 channel serial I/O..... 329.00
- CRA-100 - Cromix* adaptor board.. 45.00

CALL US FOR OUR MOST CURRENT PRICES!

*2nd Generation is a trademark of Measurement Systems and Controls. Cromix is a trademark of Cromemco, Inc. Tilt-Back is a trademark of Wabash, Inc.

16K MEMORY EXPANSION KIT $29.00

For **Apple, TRS-80** keyboard, **Exidy**, and all other systems using 4116 dynamic rams or equivalent. All IC's are prime Mitsubishi MK 4116-3.

- 200 NSEC access, 375 NSEC cycle
- Burned-in and fully tested
- 1 full year parts replacement guarantee

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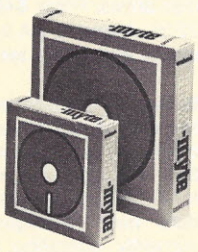

8" or 5¼" flexible diskettes certified 100% error free with manufacturers 5 year limited warranty on all 8" media. Soft sectored in tilt-back* boxes of 10. 5¼" available in 10 Sector. *(Add $3.00 for plastic library cases)*

8" single sided, single density.....$29.95
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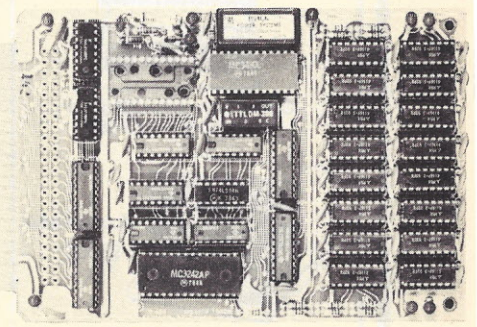
Shugart 801R.....$390.00
NEC FD1160 (double sided)..... 595.00
Memorex MRX-101 8" Winchester style, hard disk drive, 10 megabytes.....$2,000.00

6502 PRODUCTS

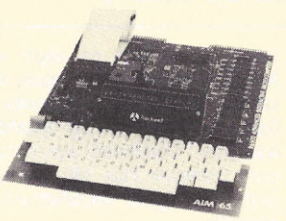


BETA 32K BYTE EXPANDABLE RAM FOR 6502 AND 6800 SYSTEMS
AIM 65 KIM SYM PET S44-BUS

- Plug compatible with the AIM-65/SYM expansion connector by using a right angle connector (supplied).
- Memory board edge connector plugs into the 6800 S44 bus.
- Connects to PET using an adaptor cable.
- Uses +5V only, supplied from the host computer.
- Full documentation. Assembled and tested boards are guaranteed for one full year. Purchase price is fully refundable if board is returned undamaged within 14 days.

Assembled with 32K RAM.....$349.00
& Tested with 16K RAM..... 329.00
Bare board, manual & 6 hard-to-get parts. 99.00
PET interface kit. Connects the 32K RAM board to a 4K or 8K PET.....$ 69.00

ROCKWELL AIM 65



AIM 65 with 1K ram.....$425.00
AIM 65 with 4K ram..... 485.00
AIM power supply..... 125.00
Professional AIM enclosure..... 169.00
Budget AIM enclosure..... 50.00
KIM enclosure..... 40.00
SYM enclosure..... 30.00

TERMS: *Minimum order $15.00. Minimum shipping and handling $3.00. Calif. residents add 6% sales tax. Cash, checks, Mastercard, Visa and purchase orders from qualified firms and institutions are accepted. Product availability and pricing are subject to change without notice.*

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ORANGE, CA 92668
(714) 633-7280

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daily, weekly, or monthly at the doctors' descretion. Up to 300 charge codes can be used for services, supplies, lab, X-rays or any items the patient is to be billed for. At the end of the month a report is generated by Med-Apple that shows M-T-D and Y-T-D activity of any particular charge code. Reports can be generated at any time to show physician activity for amounts billed and cash recepts. The system also includes automatic 30, 60, 90 + day aging with a delinquency report. A cash-to-carry feature allows the physician to bill certain patients for only the amount that is not covered by their insurance company. The system also will make patient lists by account number of alphabetically and print out mailing labels. The minimum system requirements are an Apple II Plus (48K) with three disk drives. The system also operates on the Apple III and the Corvus hard disk. Professional Medical Software, 3604 Foothill Blvd., La Crescenta, CA 91214, (213) 248-2884.

CIRCLE INQUIRY NO. 265

Plotter-compatible statistics is a collection of programs aimed at the researcher who requires graphical representation and analysis of data. The package performs the following tests: linear regression, exponential regression, curvilinear regression, data plotting, student t tests (paired and unpaired with calculated probability), Mann-Whitney U test and Wilcoxon paired test. A significant optional feature enables the user to generate graphical output on the Watanabe Miplot plotter. Biostatistics includes both program and data discs (DOS 3.2) as well as documentation. Minimum system requirements are Apple II Plus with 48K and two disc drives. Price: $40. A2Devices, P.O. Box 2226, Alameda, CA 94501, (213) 527-7380.

CIRCLE INQUIRY NO. 266

Billing and reporting system is designed to meet the patient management needs of the individual physician or group medical practice. The software was written specifically for the Rexon computer line using the Idol data base management system and is currently operating on Rexon computers. MIS can be installed on all Rexon computers including the RX15, RX20 and RX20-2, the RX30 and RX30-2. MIS has been tailored to handle a variety of information including patient billing and registration, appointment scheduling and forms printing. Forms printed include insurance forms, appointment reminder letters, patient statements, patient recall letters and fee tickets and/or labels. Reports are included such as patient listings, daily audit reports, daily doctor's revenue report, appointment schedule, aged trial balance listings, monthly transaction listing and others. Price: from $22,000 to $32,000. Rexon, 5800 Uplander Way, Culver City, CA 90230, (213) 641-7110.

CIRCLE INQUIRY NO. 267

Accounts receivable system carries out the on-line accounts receivable functions of a small business or a medical clinic. ACCT-M3 is specifically designed for the TRS-80 system to take full advantage of its limited hardware resources. A person with little accounting and computer experience can execute simplified accounting operations. The system is not totally invoice-oriented, so any service business including doctors and retail stores can use it. It can also be used for order entry, sales analysis, mailing lists, etc. The package consists of three programs: initialization, account manager, and report generator. Account manager lets you maintain a data base, and update it with transactions like paid invoice, unpaid invoice, credit, debit or payment. Sub-commands let you search, display, print, update, and delete records. Order entry allows multiple items to be entered one after the other. Unit cost, quantity, sales tax rate and shipping cost will be requested for input. The system calculates total amounts; if you wish, you can print invoices. The package requires a dual disk, 32K minimum memory, DOS TRS-80 system. Single disk is allowed but will cut the data base size in half. A printer is required. 80 columns are used for all reports, except aging analysis and statements, which use 120 columns. Since the program is written in Basic, modifications are easy. Price: $69. Micro Architect, 96 Dothan St., Arlington, MA 02174, (617) 643-4713.

CIRCLE INQUIRY NO. 268

Medical application package can prepare office input forms, enter patient and family histories, record patient visit symptoms, diagnosis, and treatments, prepare referral requests, prepare patient history summaries, and prepare referral reports. Medirec allows the diskette recording of up to 550 professional visits per diskette. Individual patient records can be recalled, linked together and printed either in whole or part. The system allows the practitioner to search past history files for common symptoms, diagnosis or the administration of conflicting drug treatments. The system requires a 48K Apple II, Apple II +, or Apple III, an 80 column printer, and two disk drives. A special Corvus Systems hard disk version is also available for system configurations up to 40M bytes of on line storage. Price: $199.95. Charles Mann & Assoc., 7594 San Remo Trail, Yucca Valley, CA 92284, (714) 365-9718.

CIRCLE INQUIRY NO. 269

Conversion utility with the Oasis operating system for Z80 microcomputers easily exchanges data files with most IBM systems. The IBM3740 option can read and write IBM3740 formatted diskettes on any 8-in. floppy disk system. Compatibility features include bi-directional data transfer, full directory manipulation and ASCII/EBCDIC conversion to enhance the IBM<->Oasis transfer. Any diskette developed by either system is quickly available for use to increase the flow through information channels. Other features include: compatible single and multi-user versions for up to 16 operators; unique flexibility in maintaining public, private or shared files; versatile security and accounting controls; convenient inter-user communications; a high-level Basic compiler and interpreter with re-entrant run-time module; a general purpose text editor; and comprehensive program development tools. Price: $250. Phase One Systems, 7700 Edgewater Dr., Suite 830, Oakland, CA 94621, (415) 562-8085.

CIRCLE INQUIRY NO. 270

Business system, Microlite II, is self-contained. The typewriter keyboard has 100 key stations, a numeric pad, and 32 function keys. A 24-line by 80-character plasma display helps make the entire system compact. The computer also houses two 5¼-in. floppy disk drives that can store up to

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FOR TRS-80* Model I

CCI-100	5¼", 40 Track (102K)	**$314**

ADD-ON DRIVES FOR ZENITH Z-89

CCI-189	5¼", 40 Track (102K)	**$394**
Z-87	Dual 5¼" system	**$995**

External card edge and power supply included. 90 day warranty/one year on power supply.

RAW DRIVES
5¼" TEAC or TANDON **$ CALL** POWER SUPPLIES **$ CALL**

DISKETTES — Box of 10

5¼"	**Maxell $40**	**BASF/Verbatim**		**$26.95**
8"	**Maxell $45**	**BASF/Verbatim**		**$36.00**
PLASTIC FILE BOX–Holds 50 5¼" diskettes				**$19.00**
PLASTIC LIBRARY CASE	5¼" **$3.00**	8"		**$ 4.00**
HEAD CLEANING DISKETTE				**$25.00**
FLOPPY SAVER	**$11.95**	RINGS		**$ 6.95**

16K RAM KITS

2 for $37 **$19**

200 ns for TRS-80,* Apple II, (specify): **Jumpers** **$2.50**

SYSTEM SPECIAL

Apple II Plus 48K w/drive and controller. Epson MX-80 printer and interface. SUP-R Mod RF Modulator: List $2965 You Pay **$2299**

COMPUTERS/TERMINALS

ARCHIVES	64K, 2-Drives, 77 Track			**$ CALL**
ALTOS	ACS8000 Series			**$ CALL**
TRS-80*	II-64K **$3499**		III-16K	**$ 899**
ZENITH	48K, all-in-one computer			**$2200**
ZENITH	Z-19			**$ 725**
TELEVIDEO	920C **$ 729**		950	**$1039**
IBM	3101 Display Terminal			**$1189**
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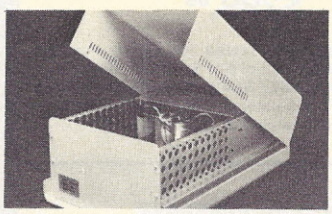
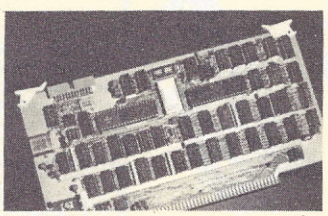
APPLE PERIPHERALS				**$ CALL**

S-100 CALIFORNIA COMPUTER SYSTEMS





MAINFRAME	Model 2200A	**$349**
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16K STATIC RAM, 200ns	Model 2116C	**$309**
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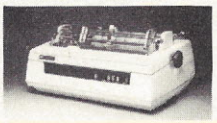
FLOPPY DISC CONTROLLER	Model 2422A	**$345**
EXTENDER BOARD	Model 2520K	**$ 52**
2P + 2S I/O	Model 2718A	**$309**

PRINTERS



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R.O.	**$2395**
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Microline 80	Friction, and pin & tractor feed			**$ 500**
Microline 82	Friction & pin feed feed			**$ 615**
Microline 83	120 cps, uses up to 15" paper			**$ 849**
CENTRONICS	739, new model with graphics			**$ 825**

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BELL & HOWELL	9" B & W BHD911		**$195**
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EXCLUSIVE ACOUSTIC CHAMBERS

The exclusive triple seal of Livermore's new flat mounted cups locks the handset into the acoustic chamber yielding superior acoustic isolation and mechanical cushioning. Designed to adapt to most common handsets used throughout the world, the STAR offers the utmost in flexibility and transmission reliability.

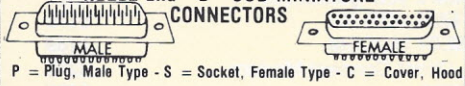
Specifications:
- **Data Rate:** 0 to 300 baud
- **Compatibility:** Bell 103 and 113; CCITT
- **Frequency Stability:** ±0.3 percent. Crystal controlled
- **Receiver Sensitivity:** —50 dBm ON, —53 dBm OFF
- **Modulation:** Frequency shift keyed (FSK)
- **Carrier Detect Delay:** 1.2 seconds ON; 120 msec OFF
- **EIA Terminal Interface:** Compatible with RS 232 specifications
- **Teletype Interface:** 20 milliampere current loop
- **Optional Interfaces:** IEEE 488; TTL; TTY 43
- **International (CCITT) frequencies available**
- **Switches:** Originate/Off/Answer; Full Duplex/Test/Half Duplex
- **Indicators:** Transmit Data, Receive Data, Carrier Ready, Test
- **Power:** Supplied by 24 VAC/150 MA UL/CSA listed wall-mount transformer. Input 115 VAC, 2.5 watts. (A 220 VAC, 50 Hz adaptor is available upon request.)
- **Dimensions:** 10" x 4" x 2"
- **Weight:** 1.74 lbs. (3 lbs. shipping weight including AC adaptor.)
- **Warranty:** Two years on parts and labor, excluding the AC adaptor which carries the manufacturer's warranty

Part No.	Description	List Price	SALE PRICE
LIV-STAR	RS232, TTL, 20 MA Current Loop	$199.00	$129.00

CABLES

Part No.	Description	Price
CND-RS2328F	RS232 8 Cond 8 ft.	$19.95

RS232 and "D" SUB-MINIATURE CONNECTORS



P = Plug, Male Type - S = Socket, Female Type - C = Cover, Hood

PART NO.	DESCRIPTION	PRICE 1-9	10-24	25-99
CND-DE9P	9 PIN MALE	$ 2.10	$ 1.90	$ 1.70
CND-DE9S	9 PIN FEMALE	$ 2.70	$ 2.40	$ 2.10
CND-DE9C	9 PIN COVER	$ 1.50	$ 1.25	$ 1.10
CND-DA15P	15 PIN MALE	$ 2.75	$ 2.45	$ 2.15
CND-DA15S	15 PIN FEMALE	$ 3.95	$ 3.60	$ 3.20
CND-DA15C	15 PIN COVER	$ 1.50	$ 1.30	$ 1.10
CND-DB25P	25 PIN MALE	$ 3.00	$ 2.75	$ 2.60
CND-DB25S	25 PIN FEMALE	$ 4.00	$ 3.75	$ 3.50
CND-DB51212	1 PC. GREY HOOD	$ 1.60	$ 1.45	$ 1.30
CND-P25H	2 PC. GREY HOOD	$ 1.50	$ 1.25	$ 1.10
CND-DB51226	2 PC. BLACK HOOD	$ 1.90	$ 1.65	$ 1.45
CND-DC37P	37 PIN MALE	$ 5.80	$ 5.10	$ 4.45
CND-DC37S	37 PIN FEMALE	$ 8.70	$ 7.70	$ 6.70
CND-DC37C	37 PIN COVER	$ 1.80	$ 1.55	$ 1.30
CND-DD50P	50 PIN MALE	$ 8.75	$ 7.75	$ 6.70
CND-DD50S	50 PIN FEMALE	$11.65	$10.25	$ 8.90
CND-DD50C	50 PIN COVER	$ 2.00	$ 1.80	$ 1.60
CND-D20418	HARDWARE SET 2 PR.	$ 1.00	$ 0.80	$ 0.70
CND-RS2328F	RS232, DB25P, EIA CLASS1CABLE8CON. 8FT.	$19.95	$17.95	$15.95
CND-5730360	CENT. 700 SERIES PRINTER CONNECTOR	$ 9.00	$ 7.50	$ 6.00

GOLD S-100 CONNECTORS
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Part No.	1-9	10-24	25-99	100-249
S100 STG	3.50	3.20	2.80	2.50

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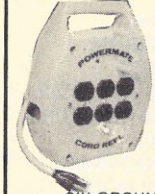

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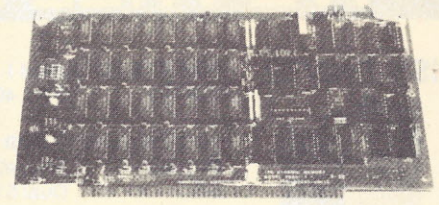

THE UNIVERSAL IEEE-S100 DYNAMIC MEMORY CARD

THE EXPANDALBE 1 TM 64K Dynamic Ram board provides your S-100 system with 64K of reliable, high-speed dynamic RAM. Compatible with most of the major S-100 systems on the market, including those with front panels, it supports DMA operations and requires no Wait states with current microprocessors.

- *User expandable from 16 to 64 K*
- *2 or 4 MHz operation*
- *North Star compatible*
- *Cromemco Compatible*
- *Designed to IEEE proposed S-100 bus standards*
- *Supports IMSAI-type front panels*
- *Operates with either an 8080 or Z-80 based S-100 system, providing processor-transparent refreshes with both*
- *Bank-select system allows system memory expansion and is compatible with Cromemco products*
- *Bank select port's address is jumper selectable*
- *Any 16K block can be made bank-independent*
- *All 64K can be made bank-enabled on power-on and reset*
- *Configuration as a 16K, 32K, or 48K board without the removal of RAMs*
- *Fully buffered address and data lines*
- *Fail-safe refresh circuitry for extended Wait states*
- *Board configuration with reliable, easy-to-configure Berg jumpers*
- *Supports DMA*
- *Jumper-selectable Phantom input*
- *Uses Popular 4116 RAMS*
- *Assembled & tested*
- *All ICs in sockets*
- *Power supply: Unregulated +8, +16, and −16 volts*
  Maximum power draw: 400 mA at +8 volts
  175 mA at +16 volts
  5 mA at −16 volts
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- *Humidity: 0 to 90% noncondensing*
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- *FR-4 glass epoxy*
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Factory Assembled and Tested 16K Board. For additional memory order 1 set of 8 4116's at the left for each additional 16K. ***PRIORITY ONE ELECTRONICS*** can supply the board A&T populated to 32K, 48K, or 64K at additional cost, see our catalog or call for pricing.

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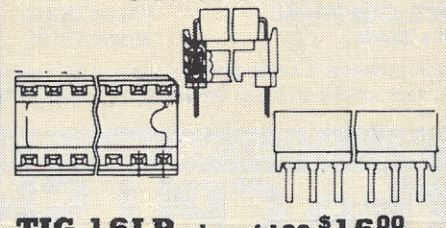

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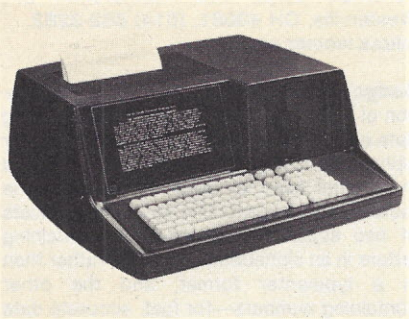
350,000 characters per disk. An optional dot matrix printer can be housed in the



console. Options include floppy disk drives with a 500K-byte 8-in. capacity. Up to four of these drives can be supported. Rigid disk drives with 27/54/208M-byte removable or 24/40 Winchester fixed media are available for data base applications where high speed and larger capacity are needed. Q1 Corp., 125 Ricefield Lane, Hauppauge, NY 11787, (516) 543-7800.
CIRCLE INQUIRY NO. 271

Text editor and processor package for TRS-80, combined with the Centronics 737 printer can produce near-typewriter-quality documents with a professional appearance, formatted with special print features. Newscript requires 48K bytes of memory and preferably two disk drives, though you can make do with one. The blinking cursor can be placed anywhere on the display for making insertions, deletions, or for typing over previous text. There are also some forty edit commands, which allow global searching, text movement, file handling, alterations, insertions and deletions. It can take specified references and include them in a table of contents and/or an index. Imbedding of special files allows standard text or logos to be placed in a document as needed. The read command inserts—selectively if desired —names and addresses in a form letter. Price: $99.95. Prosoft, Box 839, N. Hollywood, CA 91603.
CIRCLE INQUIRY NO. 272

Word processing program brings a new dimension of power and sophistication to Cromemco systems. Writemaster incorporates a completely novel command structure that approximates the flow of natural language and provides commands and single key stroke functions that ease document creation. It is capable of mail merging, index generation, and many powerful text formatting functions. All text formatting commands and function keys operate in real time when applied. Some of the commands include: alignment of left margin of all or any part of user specified text; left or right justification of text with optional incremental spacing; automatic word wrap; automatic page boundary display; variable line spacing; page numbering and heading insertion; line centering; and single key alignment and left-right justification using function keys. The package is available on 5-in. diskette or 8-in. diskette. Price: $595. Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043, (415) 964-7400.
CIRCLE INQUIRY NO. 273

Payroll program employs Apple Computer Co.'s Run Time Module. This allows programs written in Pascal to be run on an ordinary Apple II with DOS 3.3 without a special language card. The payroll has a capacity of 300 employees, 15 divisions, and 30 deduction types. It computes all federal and state income taxes plus other state and local

taxes for all 50 states. Tax formulas are built in and need not be entered by the user. Update is provided at low cost. Prints checks, check register, W-2 forms, all quarterly and summary reports. Requires two disk drives. Price: $395. Borderbund Software, Box 3266, Eugene, OR 97405, (503) 343-9024.
CIRCLE INQUIRY NO. 274

Accounting software bridges the minicomputer/microcomputer world, having been developed and made available for DEC equipment. Multi Journal Accounting runs in a compiled format, allowing faster operation. Additionally it allows system growth while retaining the software operating features; avoiding costly retraining and transition periods. It is well suited for the Gnat System 10 line of desktop computers with their progressive disk storage capabilities. MJA is a fully integrated accounting system consisting of five modules: general ledger, accounts receivable, accounts payable, payroll and order entry/inventory. Modules may be purchased individually to compliment manual bookkeeping systems or as a package to implement an integrated computer accounting system. Multi-company and departmental accounting are featured. The system provides a full range of management and accounting reports; sales journal, sales analysis, margin analysis, cash receipts/ disbursements, purchase journals. Gnat Computers, Inc., 7895 Convoy Ct., Bldg. 6, San Diego, CA 92111, (714) 560-0433.
CIRCLE INQUIRY NO. 275

Pocket computer, the Sharp PC-1211 boasts 1.9K RAM memory which is programmable through the keyboard. With the addition of the optional CE-121 or CE-122

cassette interfaces, the user can expand his storage capability by interfacing with a cassette recorder. The printer option allows the user to keep a record of his programs and to print out results. The machine employs the easy-to-understand Basic programming language and features a program capacity of 1,424 memories with 26 variables. The alphanumeric keyboard is arranged in the familiar "QWERTY" typewriter format, and both characters and numerals appear on the 24-digit dot-matrix liquid crystal display panel. Price: $249.95. Sharp Electronics, P.O. Box 204, Wayne, NJ 07470, (800) 526-2801.
CIRCLE INQUIRY NO. 276

Golf handicapping system is used in conjunction with an Apple II microcomputer. Scorecard is the only computer system that interfaces directly with the USGA handicapping system. With this capability, participating organizations can transmit their members' handicaps to the association in a matter of seconds. The system can be easily customized to meet the specifications of each golf organization. Club and course names, handicap groups, and course ratings will be adjusted for each organization's system. Telesphere Corp., 1605 John St., Fort Lee, NJ 07024, (201) 886-2476.
CIRCLE INQUIRY NO. 277

Word processing software expands the current uses of the Apple III. Type-Righter was created for use by those needing greater efficiency in typing letters, memos, and documents of less than 10 pages. It makes full use of the Apple III's 80 character screen and fast processing speed. The program has simplified almost all command functions into single letter form for ease and speed of use. Some of the functions are: automatic justification as text is entered, global search and replace of words and phrases, ability to move text easily throughout the document, adjustable tabs, ability to add individual files in any order wished, and individual line centering. The display will show the user exactly how the work will be printed, with automatic margin sets that center the work on the page. Print type is selectable for either Pica or Elite. It also includes automatic envelope addressing. Price: $195. Imagineering Inc., c/o Adcast Advertising, 405 S. Farwell, Suite #10, Eau Claire, WI 54701, (715) 835-8611.
CIRCLE INQUIRY NO. 278

Property appraisal system package for the Star 64 insurance agency management system makes it easier for insurance professionals to accurately appraise residential, commercial and business properties. The latter is a powerful system designed specifically for management of independent insurance agencies. The system uses the Durango desktop computer and was designed to maximize the efficiency and cash flow of the agency. Its features include an integrated accounting system, marketing and prospecting tools, automated letter writing, Acord form, claims processing, and property appraisal. Durango Systems, 3003 N. First St., San Jose, CA 95134.
CIRCLE INQUIRY NO. 279

Appointment calendar helps a microcomputer user keep track of various events by time and date. Schedule will record a full year of events—ten events per day for 366 days. Events may be timed or untimed; timed events are sorted in order and printed or displayed ahead of untimed events. All items are held unless deleted. List or display events by day or for any selected period.

The equipment required is a North Star disk drive, either single density or larger, 32K or RAM, and the NS operating system and Basic. Price: $19.95 Azimuth Assoc., P.O. Box 1636, Arlington, VA 22210.
CIRCLE INQUIRY NO. 280

File-keeping system provides: user defined formats; index on any field at any time; ultra fast sort; wild card search; up to 9 pages per record; full screen edit; search on any combination of fields; format lists and mailing labels; self-prompting single keystroke commands; automatic data compaction; combine and convert files; change format on existing files; elegant human engineering; exclusive datalock electronic key protection. File-manager 800 creates mailing lists, inventory and business records, and customer lists. It requires 40K and a disk drive. Price: $94.50. Synapse Software, 820 Coventry Rd., Kensington, CA 94707.
CIRCLE INQUIRY NO. 281

Job control system operates on the Apple II computer and provides management with reliable measures of productivity furnishing up-to-the-minute job status data for determining the real cost of producing a product or providing a service. All labor hours, material costs, outside service costs, production quantities and shipped quantities are posted to the system. It then consolidates and files everything for ready access as needed. Reports include job listings, job cost

summaries, detailed individual job reports, and work-in-progress reports. The program requires a 48K Apple II with the Pascal language, three disk drives and a 132-column printer capable of performing a form feed. Price: $750. High Technology Software Products, Inc., 8001 N. Classen Blvd., P.O. Box 14665, Oklahoma City, OK 73113, (405) 840-9900.
CIRCLE INQUIRY NO. 282

Color graphic terminal option, Macrofont, for the IDT-2000 provides the ability to automatically scale smoothly ASCII characters from one to twenty times their size. This allows for characters to be displayed in any combination of eight colors with variable horizontal boldface, variable vertical boldface, variable depth of shadow for a 3-dimensional effect if desired, and variable character spacing. This is very useful for ease of titling displays for process control applications, business graphics, and any presentation requiring large letters or numbers. Free formed dot addressable and vector formed pictures that are easily programmed are other outstanding features. They may be stored within the terminal in either RAM or PROM for rapid display with minimum communication from the host computer. Industrial Data Terminals Corp., 173 Heatherdown Dr., Westerville, OH 43081, (614) 882-3282.
CIRCLE INQUIRY NO. 283

Badge reading terminal offers a combination of keyboard, light-pen and badge-reading data-entry capabilities with a 32-character alphanumeric display. All of this is enclosed in a metal case to meet demands of the factory environment. The keyboard consists of two separate keypads—one containing letters in an alphabetic sequence rather than in a typewriter format, and the other containing numbers—for fast, accurate data input by non-clerical employees. The light pen can read data even if it is tilted at a 45° angle in any direction from the vertical. The pen tip is removable for cleaning; no recalibration of the pen is ever needed. The badge reader is mounted on top of the terminal, and features a sloping entrance to the bar-code slot to speed card insertion. The blue-green display provides readability in all working environments. Price: $1,935. Identicon Corp., One Kenwood Circle, Franklin, MA 02038, (617) 528-6500.
CIRCLE INQUIRY NO. 284

Three microcomputer systems are: System 1010 with 10M-byte disk drive for entry-level users; Stretch 1000 with up to 1M-byte RAM and true hardware memory mapping for data base management; and the multi-processor MP-1000 which provides up to 16 users with independent microprocessors, sharing common disk storage. All three use CSSN's proprietary version of a CP/M-compatible hard-disk operating system that speeds data access ten-fold. The popular Z-80 microprocessor is at the heart of all three systems. Other common hardware includes 64K RAM, 10 to 169M-byte disk drives, a 13M-byte cartridge tape drive and controller that interfaces up to four drives, and an IEEE S-100 bus with spare slots for system expansion. To ensure data file protection, each system features CSSN's BackUp integral hardware/softwre cartridge tape subsystem. BackUp software allows file-by-file save and restore operations and is more flexible than typical bit-stream devices because each file is independently accessible.The entry-level System 1010 with a 10M-byte disk and 64K RAM is priced from $10,900. CSSN, 120 Boylston St., 4th Floor, Boston, MA 02116, (617) 482-2343.
CIRCLE INQUIRY NO. 285

Communications processor contains a sophisticated single board microcomputer and 16K RAM. It performs print buffering similar to the effect generated by a software printer spooler. Connected between your computer's RS 232C ASCII asynchronous output port and your printer's RS 232C input port, the box buffers up to 16,000 characters of transmitted data from the computer at up to 9600 baud while simultaneously transmitting the data to the printer, also at up to 9600 baud. Input/output baud rates are jumper selectable and both positive and negative handshake levels are available on the standard 25-pin D connectors. Price: $595. Carolina Business Computer, Inc., Oakwood Center, 350 3rd Ave. NW, Hickory, NC 28601, (704) 322-6005.
CIRCLE INQUIRY NO. 286

TERMS of SALE: Cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. **Minimum Order $15.00.** California residents add 6% tax. Minimum shipping & handling charge $3.00. **Pricing & availability subject to change without notice.**

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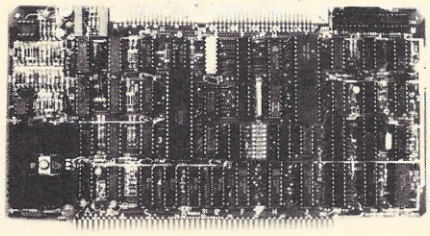

S-100 bus compatible • Reads and writes single or double density • Density is software selectable • CP/M® 2.2 compatible in single or double density • Controls up to four 5-1/4" or 8", single or double-sided drives • Single or double-sided drives may be mixed in the same system • On-board Z-80A to assure reliable operation • EIA level serial printer interface on board, baud rates to 9600 (perfect for despooling operations) • 2K of RAM on-board • Uses IBM standard formats • Designed to meet IEEE signal disciplines • Works with 8080, 8085, and Z-80 CPU's • 4-layer PC board with internal power and ground planes provides very stable, low-noise operation.

IOD-1200B *Bare board* **$59.95**
IOD-1200K *Kit* **$299.95**
IOD-1200A *A & T for 8"* **$375.95**
IOD-1205A *A & T for 5¼"* **$395.00**
SFC-58001200E *DD boot PROM* **$20.00**
SFC-59002001F *CP/M 2.2 for DD* . **$150.00**

JADE Memory Bank ™

8 or 16 Bit Dynamic Memory

New, from JADE (naturally), an IEEE S-100 64K dynamic memory that looks toward the future. • IEEE S-100 standard pinout and signal discipline • Expandable to 16 Megabytes via switchable port OR extended address lines • 8 or 16 bit words, automatically, depending on the type of CPU on the bus • 4-layer PC board for extremely low-noise operation.

The new JADE Memory Bank™ is one of the safest places you can store your valuable program information. With its on-board refresh controller, this board allows DMA operations without regard to time factors. It will run reliably at any system clock rate up to 6 MHz--because it is clocked with the system clock itself (no one-shots are used for timing operations). Its unique IEEE design enables it to switch from a 64K by 8-bit board to a 32K by 16-bit board automatically (responds to IEEE's 16 Rqst line and, if enabled, replies with 16 Grant).

On-board M1 wait-state generator allows the use of slower memory, and a unique on-board precharge extender makes this board run reliably with any manufacturer's 4116 memory chips.

Compatible with Cromemco and other CPU systems -- features enough optional strapping to enable it to run with any Z-80/Z8000 system.

MEM-99730B *Bare Board* **$49.95**
MEM-99730K *Kit, no RAM* **$199.95**
MEM-16730K *16K kit* **$219.95**
MEM-32731K *32K kit* **$239.95**
MEM-48732K *48K kit* **$259.95**
MEM-64733K *64K kit* **$279.95**
Assembled & Tested ..... *add* **$50.00**

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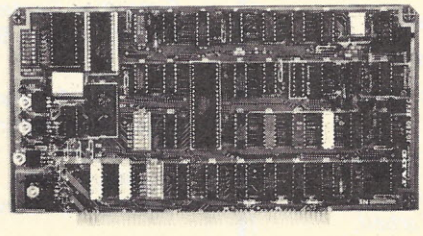
Z-80A Based CPU



S-100 bus compatible • Switch selectable 2 or 4 MHz operation • Serial I/O port • Accomodates a 2708, 2716, or 2732 EPROM in shadow mode allowing full use of 64K RAM • MWRITE signal is generated automatically if used without front panel • On-board 8251 USART controls serial port at baud rates from 75 to 9600 baud • Switch selectable 1K, 2K, or 4K boundary fully buffered • Power-on jump to EPROM

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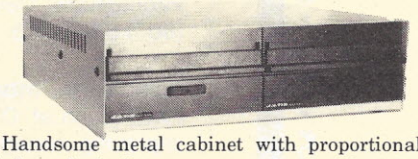

Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

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END-000433 *Kit w/2 SA-801Rs* ... **$999.95**
END-000434 *A & T w/2 SA-801Rs* **$1195.00**

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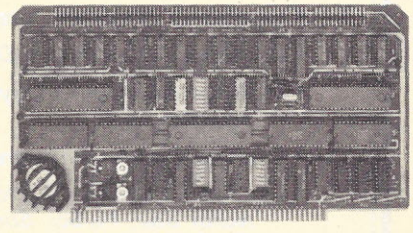
Our "SPICy" New I/O Board



New, from JADE, one of the most advanced, technologically sophisticated Serial/Parallel Interrupt Controller systems in the world. On a single IEEE S-100 standard board, JADE has packed two bi-directional parallel ports with full handshaking, four serial channels (asynchronous, IBM-compatible bi-synch, synchronous, HDLC/SDLC) with complete modem control lines, and 16 counter-timer channels.

Utilizing the highly advanced Zilog peripheral chips, (Z-80 SIO, PIO & CTCs), the SPIC board is fully programmable to serve as the foundation for a multi-user multi-tasking system. Although the board can be operated in an 8080/8085 system, we recommend its use with a Z-80/Z8000 system utilizing the powerful Z-80/Z8000 interrupt Mode 2. Each of the seven Z-80 peripheral chips can generate its own interrupt vector, with daisy-chain priority levels. Each counter-timer channel can be programmed to monitor an interrupt vector line on the S-100 bus, to serve as an interval timer or real-time clock, and to operate as a software controllable baud rate generator. Each SIO channel can be driven independently with separate Tx/Rx clocks for each channel, so your peripherals can have varied baud rates, from 110 to 76,800 baud

In addition, this board can serve as a data concentrator link to an IBM, DEC, or Data General mainframe computer, utilizing a high-speed serial channel that is programmable to virtually any protocol.

IOI-1045B *Bare board & manual* **$49.95**
IOI-1045K *Kit, standard* **$179.95**
IOI-1045A *A & T, standard* **$239.95**
IOI-1046K *Kit w/full chip set* **$219.95**
IOI-1046A *A & T w/full chip set* ... **$299.95**

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Now, for the first time, at an amazingly low price, CP/M and SDOS users can get an affordable business software package. Just look at these programs! All come complete with basic code (written to run under CBASIC I), for easy customizing and modification. All software is self-documenting. The package price includes a word-processing system. When printed on the system's printer, all files with the extension xxxTOT. constitute a complete manual. No manuals are supplied with the package other than as they appear on the disks. All software is supplied on 8" premium quality JADE Diskettes. Software sold as is. (Sorry, but at these low prices we can not offer our usual friendly support and handholding.)

Includes; General Ledger, Payroll, Invoicing, Inventory Control , Accounts Recievable, Cash Disbursements, Fixed Assets, Cash Receipts, & Mailing List Management.

Special Package Price ***$249.95***

CALENDAR

Sep 1-3 Computerized Office Equipment Expo, Civic Center, Atlanta, GA, displaying new equipment for data and word processing, information management, telecommunications, records storage/retrieval and micrographics. Also held Oct 20-22 at Astrohall in Houston, TX and Apr 6-8 '82 at O'Hare Exposition Center, Rosemont, IL. Cahners Exposition Group, 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

Sep 10-12 Personal Computer World Show, Cunard Hotel, Hammersmith, London, England, demonstrations and discussions on wide variety of small computer systems. Timothy Collins, Personal Computer World Show, 11 Manchester Sq., London WIE 2QZ, England.

Sep 14 Invitational Computer Conference, Boston Marriott, Newton, MA, seminar/display directed towards the needs of quantity buyers of computer and peripheral equipment. Also held: Oct 1, Radisson South, Minneapolis, MN; Oct 27, Sheraton Hotel, Valley Forge, PA; Oct 29, Tyson's Marriott, Washington, DC. B.J. Johnson & Assoc., 2503 Eastbluff Dr., Suite 203, Newport Beach, CA 92660, (714) 644-6037.

Sep 14-17 Software Info '81, Merchandise Mart Expocenter, Chicago, IL, talks and demonstrations on increasing productivity through packaged software. Software Info, 1730 N. Lynn St., Suite 400, Arlington, VA 22209, (703) 521-6209.

Sep 15-17 Wescon '81, Brooks Hall and Municipal Auditorium and Hilton Hotel, San Francisco, CA, conferences and demonstrations on aerospace avionics, data communications, components and devices, consumer electronics, energy, medical electronics, and office automation. Electronic Conventions, Inc., Suite 410, 999 N. Sepulveda Blvd., El Segundo, CA 90245, (213) 772-2965.

Sep 15-24 Machine Tool Fair, Hanover Fairgrounds, Hanover, Germany, more than 1,700 exhibitors from 80 different countries presenting new developments in machine tools and general metalworking technologies. Hanover Fair Informations Center, Box 338, Whitehouse, NJ 08888, (800) 526-5978.

Sep 16-18 Integrated Management Systems Seminar, Holiday Inn at O'Hare Airport, Schiller Park, IL, course on improving management skills, tailored to the needs of the electronics industry. EIA Education, Suite 405, 2001 Eye St. N.W., Washington, D.C. 20006.

Sep 21 Robotics course, Centennial College, Ontario, Canada, first in a series of ten-week courses running through November. This course covers the usage of robots in industry. Other courses and beginning dates: digital logic and microprocessors, Sep 22; history of programmable controllers, Sep 23; Intel 8080 and 8085 microprocessors, Sep 24. Coordinator of Technical Programs, Centennial College of Applied Arts and Technology, Box 631, Station A, Scarborough, Ontario, Canada, M1K 5E9.

Sep 21-23 Structured Information Systems Seminar, series of two-and-a-half day seminars designed for DP/MIS management; focusing on a structured approach to information systems planning. Susan Shaw, InfoCom, MRB Box 125-17, Bangor, ME 04401, (207) 947-6886.

Sep 21-25 Convention Informatique 1981, Palais des Congres, Paris, France, discussions on office automation and telematics, legal, economic and social aspects of computerization. Secretariat de la Convention Informatique 4, Place de Valios, 75001 Paris, France, telephone (01) 261.52.42.

Sep 21-25 International Switching Symposium, Hotel Bonaventure, Montreal, Canada, discussions on telecommunications switching, including representatives from around the world. International Switching Symposium, P.O. Box 56, Station "Ile des Soeurs", Verdun, Quebec, Canada H3E 1J8, (514) 761-5831.

Sep 22-24 National Electronics Packaging and Production Conference, O'Hare Exposition Center, Rosemont, IL, more than 275 displays relating to the design processing and manufacture of printed circuit boards and microelectronic devices. Cahners Exposition Group, 222 W. Adams St., Chicago, Il 60606, (312) 263-4866.

Oct 2-3 Classroom Applications of Computers, Independence High School, Santa Clara, CA, conference including hands-on tutorial sessions for teachers with several different hardware types at several levels of sophistication; also workshops and industrial exhibits of hardware and software. Don McKell, Independence High School, 1776 Educational Park Dr., San Jose, CA 95133, (408) 288-7642.

Oct 7-21 Far East Consumer Electronics Tour, Japan, South Korea, Taiwan and Hong Kong are the sites for four big trade shows. The tours will include briefings by government and industry leaders, facility tours and individual business appointments. Terry Butler, Commerce Tours International, 870 Market St., Suite 742, San Francisco, CA 94102, (415) 433-3072.

Oct 12-15 Info 81, New York Coliseum, New York, NY, discussions and data on increasing the responsiveness of information systems, including hardware and software exhibits. Clapp and Poliak, 245 Park Ave., New York, NY 10167, (212) 661-8410.

Oct 24 New Jersey Microcomputer Show and Fleamarket, Holiday Inn (N.) Convention Center, Newark Airport, Newark, NJ, over 100 vendors of microcomputer equipment and user group meetings of many popular systems. Kengore Corporation, 3001 Route 27, Franklin Park, NJ 08823, (201) 297-2526.

Oct 31-Nov 1 Computers in Ambulatory Medicine, Sheraton Hotel, Washington, DC, joint annual conference of the Advanced Medical Systems and the Society for Computer Medicine. SCM, 9650 Rockville Pike, Bethesda, MD 20014, (301) 530-7120.

BOOK REVIEWS

Fifty Basic Exercises
by J. P. Lamoitier
Sybex, Berkeley, CA

Reviewed by Dennis Doonan

This excellent book shows the power of a systematic approach to programming. It teaches Basic without talking down to the reader. It is geared for readers with some technical or scientific background who want realistic examples, rather than watered-down lists of statements and commands.

Problem solving, program development and programming procedures are stressed. Basic is progressively learned with functional examples. Detailed problem analyses, flowcharts, program listings and sample runs are included. This top-down approach results in easy to follow modular program segments. The procedures and programs developed in the text provide a sound basis for the reader to design complex application programs.

Simple, yet practical, exercises gradually build in complexity and difficulty. A broad range of application problems are presented in the fields of mathematics, business, operations research, statistics and games.

Chapters on mathematics, statistics and finance consider integer manipulation, geometric problems and various calculations. Data processing and operations research chapters discuss sorting, planning, graph manipulation and subtle use of variables to perform complex tasks. The easy-to-follow discussion on sorting is unique. The slow bubble sort is omitted in favor of the faster, more practical shell sort.

250 pages $12.95

How to Program and Interface the 6800
by Andrew C. Staugaard, Jr.
Howard W. Sams, Indianapolis, IN

Microprocessors and microcomputers in general are introduced by an in depth study of the 6800. The book begins with basic concepts and assumes knowledge of number systems and digital electronics.

The book stresses practical applications and includes 30 experiments that can be performed with the Heath ET-3400 trainer or the Motorola MEK 6800 D2.

The first section deals with the internal architecture of the 6800, its instructions and general programming techniques. It starts by explaining the difference between a microprocessor chip, a microcomputer chip and a microcomputer system. Internal operations are described, as a fetch and execute series is followed through a simple program.

The 6800's arithmetic, logical and data handling instructions are described with the operation of the condition code register. Stack operations, branching and indexing are also described in detail.

The second half of the book emphasizes 6800 hardware and interfacing techniques required to form operational systems. General concepts of input/output are discussed, including programmed and interrupt techniques, tri-state buffering, latching and decoding. Details of smart I/O chips such as the 6820/6821 PIA are also provided.

A chapter on memory interfacing describes the available memory devices that allow efficient design in user applications. The use of both read/write and read only memories are also described.

Interfacing information provides the hardware and software considerations necessary to connect the 6800 to switches, keyboards, displays, digital-to-analog and analog-to-digital converters. **—DD**

414 pages $13.95

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If you're continuously asked to do applications programs and don't have time to do it in BASIC, consider FMS-80. For additional information contact

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*TM of Digital Research, Pacific Grove, CA

Free Literature

The Future Starts Now, a six-page, full-color brochure, describes the Artelonics series 1000 office computer. The brochure details applications and specifications and includes a diagram on the 1000's modular architecture. Artelonics, 2952 Bunker Hill Ln., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 201

Computer graphics are described in a 12-page pamphlet, "Matching Colorgraphics To Your Management Information System." It is directed toward managers suffering from "information indigestion" described as an ever-growing diet of computer-printed statistics. The booklet examines color graphics as an alternative to tabular paper printout in meeting the dynamic needs of management information systems. Ramtek Corp., 2211 Lawson Ln., Santa Clara, CA 95050.

CIRCLE INQUIRY NO. 202

Data modem is described in two-page data sheet. The model 920 RF is available from Interactive Systems/3M. The booklet describes the model's features and advantages and includes device interface, RF characteristics and mechanical interfaces information. Interactive Systems/3M, 3M TelComm Products Div., Box 33600, 3M Center, St. Paul, MN 55133.

CIRCLE INQUIRY NO. 203

Software catalogs describe applications for the TRS-80, Apple and TI 99/4 computers. The offerings feature products for the business, educational, and personal markets. The firm, which stocks software from over fifteen major suppliers, has just completed its pre-season major software purchases and offers discounts on its offerings of up to 30%. Also included are specialized applications for the medical and dental professions. Creative Discount Software, 256 S. Robertson Blvd., Beverly Hills, CA 90211.

CIRCLE INQUIRY NO. 204

Buyer's guide represents the state of the art in efficient microcomputer software and includes over 50 media formats listed, CP/M compatible disk operating systems, hard disk integration modules, system tools, telecommunications, languages, language and application tools, word processing systems and aids. Also listed are data management systems, general purpose applications, mail list systems, financial accounting packages, numerical problem-solving tools, professional and office aids, and books, periodicals and accessories. Catalog Dept., Lifeboat Assoc., 1651 3rd Ave., New York, NY 10028.

CIRCLE INQUIRY NO. 205

Data communication products are listed in 35-page catalog featuring Hawk 4000 series datatraps that provide a CRT display of on-line data communications. Also described is a complete line of Range Rider data

test sets for synchronous and asynchronous modems, statistical multiplexers TDMs, and FDMs; EIA and telephone line patch, monitor, and switching modules for tech control centers; data interface cables and error detection devices. Marketing Dept., International Data Sciences, 7 Wellington Rd., Lincoln, RI 02865.

CIRCLE INQUIRY NO. 206

Rental catalog features a selection of terminals and other data processing and communications equipment available for rent or lease from the Leasametric network of branches in the U.S. and Canada. Among the data communications products included are alphanumeric and graphic CRT terminals, printing terminals and printers, storage devices, acoustic couplers and desktop computers. The catalog also features many pieces of datacommunications test equipment. Leasametric, 1164 Triton Dr., Foster City, CA 94404.

CIRCLE INQUIRY NO. 207

Uninterruptible power systems are described in brochure. Power problems like blackouts, brownouts, spikes, dips and transients that can damage sensitive electronic devices are listed. The brochure explains how an uninterruptible power system (UPS) can protect telecommunications, security, medical laboratory, process control or computer systems. Full specifications are given for 750VA to 15K VA models. Clary Corp., 320 W. Clary Ave., San Gabriel, CA 91776.

CIRCLE INQUIRY NO. 208

Software catalog features products specially prepared to operate on the Apple III computer. The catalog provides detailed descriptions of more than 50 business, word processing, educational, and personal applications for Apple computers. Medical and dental office packages and a complete school administrative system are fully described. Monument Computer Service, Village Data Center, Box 603, Joshua Tree, CA 92252.

CIRCLE INQUIRY NO. 209

Distributor products catalog, no. CD-12, includes complete mechanical/electrical/environmental specifications, dimensional drawings with conversions to millimeters, product illustrations and distributor part numbers. TRW Cinch Connectors Marketing Services, 1501 Morse Ave., Elk Grove Village, IL 60007.

CIRCLE INQUIRY NO. 210

Printed circuit board switches are detailed in 12-page catalog. The line includes 10-position and 16-position (hexadecimal) 2300 series Micro-Dip switches, the world's smallest coded dual-in-line switches with optional top and bottom seals; 2400 series Mini-Dip switches with optional environmental seal; the Strip-Switch 2100 series with a large variety of output codes; and 2500 series Low Profile for screwdriver or thumb actuation, or with optional extended shaft. Eeco Inc., 1601 E. Chestnut Ave., Santa Ana, CA 92701.

CIRCLE INQUIRY NO. 211

Game Corner

continued from page 36

Listing 5

```
10  REM  MINING THE ASTEROIDS IN APPLESOFT
50  REM  GO INITIALIZE
60  REM
70  TEXT : HOME : GOTO 540
80  REM
90  REM MAIN LOOP: PRINT DATA
100  REM
110  HOME : HTAB 2: PRINT TI;: HTAB 9: PRINT SC;: HTAB 15: PRINT FU;: HTAB
     21: PRINT H;: HTAB 28: PRINT  - V
120  REM
130  REM  READ PADDLES
140  REM UPDATE FUEL & VELOCITY
150  REM
160 A =  INT ( PDL (0) / 85) - 1
170 B =  INT ( PDL (1) / 85) - 1
180 H = H + A:FU = FU -  ABS (A)
185 HS =  ABS (H): FOR I = 1 TO 10 - 3 * HS:W =  PEEK ( - 16336): NEXT I
190 V = V + B:FU = FU -  ABS (B)
195 HV =  ABS (V): FOR I = 1 TO 10 - 3 * HV:W =  PEEK ( - 16336): NEXT I
200  REM
210  REM  MOVE SHIP/UPDATE (X,Y)
220  REM
230  COLOR= 0: PLOT X / 10,Y / 10
240 X = X + H
250  IF (X > 391) + (X < 1) THEN X = 391 - X + H
260 Y = Y + V
270  IF (Y > 391) + (Y < 0) THEN Y = 391 - Y + V
280  REM
290  REM UPDATE TIME/SEE IF HIT
300  REM IF NOT, MOVE AND LOOP
310  REM
320 TI = TI - 1
330 S =  SCRN( X / 10,Y / 10)
340  IF S > 0 THEN 440
350  COLOR= 15: PLOT X / 10,Y / 10
360  IF TI < 0 THEN 830
370  IF FU < 0 THEN 840
380  IF SC = 45 THEN 850
390  HOME : GOTO 110
400  REM
410  REM HIT:IF TOO FAST-CRASH
420  REM IF SLOW, UPDATE SCORE
430  REM
440  IF  ABS (H) > 5 OR  ABS (V) > 5 THEN 870
450 SC = SC + S
452  FOR I = 1 TO S
454  CALL  - 1052: REM  BELL
456  NEXT I
460  GOTO 350
470  REM
480  REM  INITIALIZATION
520  REM (X,Y)=SHIP LOCATION X10
530  REM
540 X = 200
550 Y = 200
552  REM  START IN CENTER
555  GOTO 900
560  REM
570  REM  H=XSPEED, V=YSPEED
580  REM
590 H = 0
600 V = 0
610  GR
620 FU = 250
630 SC = 0
640 TI = 500
650  REM
660  REM PLOT 9 COLORS ON SCREEN
670  REM NARRAY KEEPS DIGITS FROM
680  REM LANDING ON EACH OTHER
690  REM
700  DIM N(18)
710  FOR I = 1 TO 9
720 R =  INT ( RND (1) * 40):S =  INT ( RND (1) * 40)
730  FOR J = 1 TO 9
740  IF R = N(J) OR N(J + 9) = S THEN 720
750  NEXT J
760 N(I) = R:N(I + 9) = S
765  COLOR= I
770  PLOT R,S
780  NEXT I
785  VTAB 21: PRINT "TIME  SCORE  FUEL  H VEL  V VEL": POKE 34,21
790  HOME : GOTO 110
800  REM
810  REM ENDING MESSAGES
820  REM
830  VTAB 23: FLASH : PRINT "TIME'S UP";: NORMAL : END
840  VTAB 23: FLASH : PRINT "OUT OF GAS";: NORMAL : END
850  VTAB 23: FLASH : PRINT "CONGRATULATIONS---YOU GOT THEM ALL!";: NORMAL

860  END
870  VTAB 23: FLASH : PRINT "C R A S H ! ! !";: NORMAL : HTAB 28: PRINT "W
     HO'S NEXT?";
880  FOR L = 1 TO 100:W =  PEEK ( - 16336): NEXT L: END
900  HOME : VTAB 10: PRINT "DO YOU WANT INSTRUCTIONS (Y/N)?"
910  GET Y$: IF Y$ = "N" THEN 590
920  HOME : HTAB 10: INVERSE : PRINT "MINING THE ASTEROIDS": NORMAL : PRINT
     : PRINT
930  PRINT "THE OBJECT OF THE GAME IS TO SCOOP UP   ALL THE COLORED ASTERO
     IDS WITH YOUR     SPACESHIP (IN WHITE) BEFORE YOU RUN OUT OF TIME OR
     FUEL."
940  PRINT : PRINT "IF YOU TRY TO SCOOP UP AN ASTEROID      WHILE MOVING T
     OO FAST (HOR OR VERTICAL  VELOCITY MORE THAN 5), YOU WILL CRASH,  END
     ING THE GAME."
950  PRINT : PRINT "THE ASTEROIDS HAVE DIFFERENT POINT      VALUES BASED O
     N THEIR COLORS AS FOLLOWS:"
960  PRINT "RED=1  DARK BLUE=2  VIO=3  DARK GREEN=4 GRAY=5  MED BLUE=6  LI
     GHT BLUE=7        BROWN=8  ORANGE=9"
970  PRINT : PRINT "45 POINTS IS A PERFECT SCORE."
980  VTAB 23: INVERSE : PRINT "PUSH EITHER PADDLE BUTTON TO START": NORMAL

990  IF  PEEK ( - 16286) < 128 AND  PEEK ( - 16287) < 128 THEN 990
1000  IF  PEEK ( - 16286) > 127 OR  PEEK ( - 16287) > 127 THEN 1000
1010  HOME : GOTO 590
```

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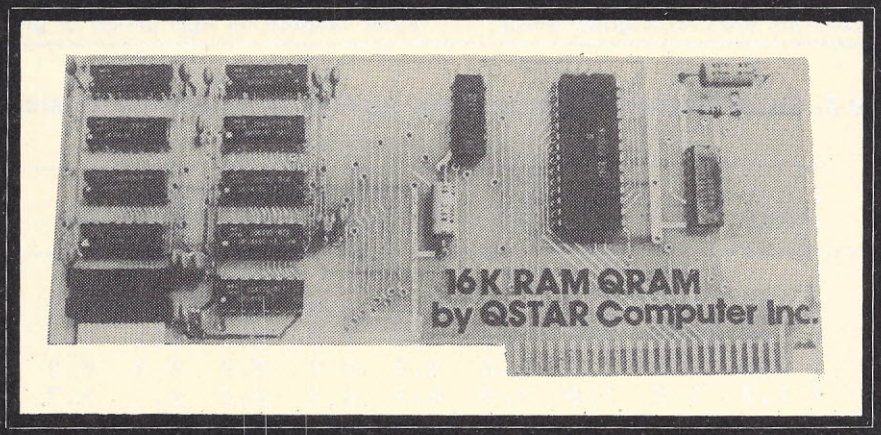

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Heart II

continued from page 68

ments in the program listing. While mortality from all causes is higher in blacks, the percentage of deaths due to heart attacks and the risk factors, are the same.

A number of people wrote that they had difficulty running the first program despite the fact that there were no bugs in the printed listing. The trouble was usually in not entering the correlation factors correctly or in the way a particular dialect of Basic handled the double-precision values used. In the present program, the data must be very carefully checked against the table, because it is very easy to make a simple mistake, like dropping one value, which would then offset the remainder of the table. Several examples should be worked out by hand from the tables to check the program.

The data are non-linear and unfortunately presented as tabular five-year age intervals, rather than correlation coefficients as in the Framingham study, making table-lookup a tedious necessity.

Following is an excerpt from the Framingham study, Section 28: "Smoothing was accomplished by use of a multiple logistic function. The parameters for this function were estimated by the method of Walker-Duncan. The function itself took the following form: $p(X) = 1/(1 + \exp - (a + bx))$ where the X(i) are the variables of interest, b(i) the corresponding parameters, with a being the intercept. p(X) is the conditional probability of the event given specific values for the x(i)."

In the interest of brevity, the listing contains only the core of the program without an output section for a formal report. These can easily be added by the user if desired.

Lines 480-770 list the risk factors as data statements spaced for legibility. This is done only for demonstration purposes as loading all the data for both sexes into a matrix would take too much time and memory. The working program should have the data for males and females stored in random-access (by age) data files on the disc drive for efficiency. A table of average weight/height might also be stored for males and females.

The data for total deaths from heart attack and all other causes by age group is given as the first two

Table 2. Geller-Gesner tables for females: Risk of Myocardial Infarction

	start of five-year age group									
	25	30	35	40	45	50	55	60	65	70
EXERCISE										
sedentary	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8
some	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4
moderate	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9
vigerous	1.0	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6
FAMILY										
none > 70	2.0	1.9	1.8	1.7	1.6	1.5	1.5	1.4	1.3	1.2
both > 70	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6
SMOKING now										
40 +/day	3.2	2.9	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4
20-39/day	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.2	1.2
10-19/day	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Never smoked	0.5	0.5	0.6	0.6	0.6	0.7	0.8	0.8	0.8	0.8
NOTE: Risk factors are not available for past smoking history in females										
WEIGHT										
+ 60%	5.9	4.6	3.5	2.7	2.1	1.6	1.2	1.0	1.0	1.0
+ 50%	3.9	3.2	2.6	2.2	1.8	1.4	1.2	1.0	1.0	1.0
+ 20%	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0
average	0.5	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.0	1.0
- 10%	0.3	0.4	0.4	0.5	0.6	0.7	0.9	1,0	1.0	1.0
Mortality/100,000 population					white females					
cardiac	14	39	112	263	548	1081	2118	3770	6610	11815
all causes	699	958	1515	2475	3874	5855	8941	13001	19312	30610
					black females					
cardiac	48	162	382	777	1462	2501	4063	5548	9146	14568
all causes	1485	2090	3245	4901	7307	10545	14844	18490	27894	41979

numbers in each data statement (assigned to the variables ASHD.DR and TOTAL.DR) for use by another program in constructing demographic tables and mortality graphs. It is not called by the present program and may be omitted. (But remember to also shorten the DATA READ statement. The data for these two variables included within the listing are for white males only).

An attempt was made to have the program then show the decreased risk attained by reducing the correctable factors (as determined from the input conditions) both singly and collectively. This proved to be very tedious coding and resulted in a very long program to consider *all* possible combinations. In keeping with the dictum to not program a computer to do something that is better done by hand, it is simpler by far to rerun the program and change the input to reflect the reduced risks. The purpose of the comments input (line 1740) is to provide an appropriate printed notation for these reruns, such as "Comments: John Doe risk if he quits smoking now". The comments variable has not been called in the brief printout given.

Some final notes: it is recognized that the degree of diabetes control also influences risk; this was tabulated as simply 'glucose intolerence' yes/no in the Framingham data. The Geller-Gesner tables factor in diabetes as yes / no / or yes-but-in-control. It is unlikely that a diabetic who was 'uncontrolled' by virtue of not seeing a physician would have the benefit of this computer program in the first place.

In males, smoking at an early age is *the* most important factor and exercise is relatively unimportant. (Remember this concerns only heart attack and not lung cancer, emphysema and all the other things linked with smoking). In females, smoking is still important, but overweight becomes *the* most important risk factor ...ahead of family history, cholesterol, blood pressure and all the rest. In the remainder of the Geller-Gesner tables (not presented here), overweight is also one of the highest identifiable factors in the other leading causes of premature death such as strokes and heart failure. In fact, after the age of 45, overweight-related deaths exceed those of cancer of all types!

The Geller-Gesner tables also consider blood pressure (both systolic and diastolic) and cholesterol, but have not been used in this program since they were adequately dealt with in the earlier version of the program. In contrast, the tables do not consider heart enlargement (as evidence of the heart being overworked) which *was* in the Framingham study and remains an important factor.

The natural question is "Why haven't all these factors been pulled together in one single body of data?" First of all, it takes a lot of money and foresight to study a significantly large population for a statistically valid (20 + years) period of time. The Framingham Project is a model of outstanding importance in collecting this data, but more significantly the answers in science often simply provoke more questions. Since we did not know 20 + years ago that quitting smoking in females might lower the risk of heart attacks, how could we ask the question in the first place? The data presented in the current program (and that in the previous version) are the best we have at this stage of coronary-risk evaluation; they have been carefully checked for accuracy and the readers are left to draw their own conclusions as to the applicability of the data. □

```
100 'HEART-2: Suppliment to the original program for the prediction of
              heart attack published in Interface Age (July,1978)
110 'Programed in Microsoft 5.2 under CP/M; April, 1981
230 'This program addresses the factors of Family History, Degree of
240 'overweight, exercise pattern and the smoking history in detail.
250 'Potential users are cautioned that this data is derived from a
260 'separate population from the 'original' Framingham Data, and in
270 'addition, the risk factors represent 8 (not 6) year projections.
280 '
290 'Data structure:  There are 10  5-year age group intervals from
300 '                  25-29,30-34,35-39.....to 70-74
310 '
320 'Each age group has 2 death rates and 22 risk factors as follows:
330 '
340 '  ASHD.DR     :Arteriosclerotic heart disease deaths/100,000 pop.
350 '  TOTAL.DR    :Deaths from all causes/100,000 pop.
360 '  EXERCISE(4):Graded as sedentary, some, moderate, or vigerous
370 '  PARENT(2)   :Neither lived past 70, or both lived >70
380 '  SMOKE(11)   :NOW SMOKING  >40/day, 20-40, 10-20, or <10
390 '                 Smoked 20/day  but quit 1 year ago, 1-4, 5-10
400 '                 Smoked >20/day and quit 1 year ago, 1-4, 5-10
410 '                 NEVER SMOKED
420 '  WEIGHT(5)   :60% over, 50%, 20%, Average, 10% under
430 '
440 ' The corresponding variables holding the patient's data are:
450 '  AGE, EX, PA, SM and WT)
460 '------------------- Demonstration data ---------------------------
470 '  Note: For demonstration purposes, the risk factors for
480 '  Males and the code needed to load them is included here.
490 '  the factors are intended to reside on random disc files
500 '  for males and females.
510 '25-29 Years
520 DATA 62,1643
530 DATA 1.0,1.0,1.0,1.0,2.1,0.4,3.0,1.7,1.0,0.6,0.7,
         0.5,0.4,1.0,0.9,0.6,0.3,1.2,1.1,0.9,0.8,0.8
540 '30-34 Years
550 DATA 214,1901
560 DATA 1.1,1.0,1.0,0.9,2.0,0.5,2.7,1.6,1.1,0.6,0.7,
         0.5,0.4,1.0,0.9,0.6,0.3,1.2,1.1,0.9,0.8,0.8
570 '35-39 Years
580 DATA 601,2752
590 DATA 1.2,1.0,0.9,0.9,1.8,0.5,2.4,1.6,1.1,0.7,0.7,
         0.5,0.4,1.0,0.9,0.6,0.4,1.3,1.2,0.9,0.8,0.8
```

```
600 '40-44 Years
610 DATA 1355,4423
620 DATA 1.2,1.0,0.9,0.9,1.7,0.5,2.2,1.5,1.1,0.7,0.7,
        0.5,0.4,1.0,0.9,0.6,0.4,1.3,1.2,1.0,0.8,0.7

630 '45-49 Years
640 DATA 2567,7203
650 DATA 1.3,1.1,0.9,0.8,1.6,0.6,2.0,1.5,1.1,0.7,0.8,
        0.6,0.4,0.9,0.9,0.7,0.4,1.4,1.2,1.0,0.8,0.7

660 '50-54 Years
670 DATA 4248,11203
680 DATA 1.3,1.1,0.9,0.8,1.5,0.6,1.8,1.4,1.1,0.8,0.8,
        0.6,0.5,0.9,0.9,0.7,0.5,1.4,1.3,1.0,0.8,0.7

690 '55-59 Years
700 DATA 6694,17306
710 DATA 1.4,1.1,0.9,0.7,1.4,0.7,1.6,1.4,1.1,0.8,0.9,
        0.7,0.6,0.9,0.9,0.7,0.6,1.4,1.3,1.0,0.8,0.7

720 '60-64 Years
730 DATA 9859,25227
740 DATA 1.5,1.2,0.9,0.7,1.3,0.7,1.4,1.3,1.2,0.9,0.9,
        0.7,0.6,0.9,0.9,0.8,0.6,1.5,1.3,1.0,0.8,0.7

750 '65-69 Years
760 DATA 13910,35403
770 DATA 1.6,1.2,0.9,0.7,1.2,0.8,1.3,1.3,1.2,0.9,1.0,
        0.8,0.7,0.9,0.9,0.8,0.7,1.5,1.4,1.0,0.8,0.7

780 DIM AGE.GROUP(10),ASHD.DR(10),TOTAL.DR(10)
790 DIM EXERCISE(10,4),PARENT(10,2),SMOKE(10,11),WEIGHT(10,5)

800 FOR AGE.GROUP=1 TO 10
810     READ ASHD.DR(AGE.GROUP),TOTAL.DR(AGE.GROUP)
820     FOR I=1 TO 4 : READ EXERCISE(AGE.GROUP,I):NEXT
830     FOR I=1 TO 2 : READ PARENT(AGE.GROUP,I):NEXT
840     FOR I=1 TO 11: READ SMOKE(AGE.GROUP,I):NEXT
850     FOR I=1 TO 5 : READ WEIGHT(AGE.GROUP,I):NEXT
860 NEXT AGE.GROUP'
    ---------------- end of demonstration data ----------------------

870 PRINT CHR$(26)                                  'clear screen
880 PRINT"CORONARY RISK EVALUATION"
890 PRINT"========================"
900 PRINT:PRINT
910 INPUT"ENTER TODAY'S DATE IN ANY FORM       ";DATE$
920 PRINT
930 INPUT"THE DOCTOR/CLINIC REQUESTING INFO    ";DOCTOR$
940 PRINT

950 INPUT"WHAT IS THE PATIENT'S NAME           ";PNAME$
960 PRINT
970 INPUT"ENTER THE PATIENT'S AGE IN YEARS     ";AGE

980 IF AGE <25 OR AGE >74 THEN PRINT:
    PRINT"MUST BE BETWEEN 25 AND 74":PRINT:GOTO 980

990 AGE.GROUP=INT((AGE-15)/5)-1
```

```
1000 '-------------------------------------------------------------
1010 ' NOTE: At this point the program would also ask for Sex
1020 '       OPEN a random file named Sex(x) and then
1030 '       Field a record numbered 'AGE.GROUP' AS the variables
1040 '-------------------------------------------------------------


1050 PRINT CHR$(26)
1060 PRINT"EXERCISE: 1} Sedentary, no exercise during work or leisure"
1070 PRINT"          2} Some, irregular light exercise"
1080 PRINT"          3} Moderate regular exercise
1090 PRINT"          4} Strenuous, competitive sports etc."
1100 PRINT:INPUT"             Enter 1-4   ";EX
1110 PRINT:PRINT

1120 PRINT"PARENTS : 1} Both parents lived past the age of 70"
1130 PRINT"          2} Neither parents lived past age 70"
1140 PRINT:INPUT"             Enter 1 or 2   ";PA

1150 '-------------------------------------------------------------
1160 'NOTE: at this point it may be desirable to ask height and weight
1170 'and calculate % normal from standard tables on a disc file.
1180 '-------------------------------------------------------------


1190 PRINT:PRINT
1200 PRINT"WEIGHT  : 1} 60% or more overweight"
1210 PRINT"          2} 50% overweight"
1220 PRINT"          3} 20% overweight"
1230 PRINT"          4} Average weight for height"
1240 PRINT"          5} 10% underweight"
1250 PRINT:INPUT"             Enter 1-5   ";WT

1260 PRINT CHR$(26)
1270 PRINT"SMOKING HISTORY"
1280 PRINT"==============":PRINT:PRINT
1290 PRINT"Smoking history' refers to cigarettes only. Data on pipe
1300 PRINT"and/or cigar smokers is not currently available.":PRINT
1310 PRINT"   The 'number' refers to cigarettes/day NOT packs/day."
1320 PRINT:PRINT

1330 INPUT"   DOES THE PATIENT SMOKE NOW {Yes/No} ";Q$
1340 IF LEFT$(Q$,1)="N" THEN PRINT:PRINT:GOTO 1440
1350 IF LEFT$(Q$,1)<>"Y" THEN PRINT:GOTO 1340
1360 PRINT
1370 INPUT"   HOW MANY CIGARETTES PER DAY         ";Q
1380 IF Q<=2 THEN PRINT:PRINT"INDIVIDUAL CIGARETTES, NOT PACKS":
     GOTO 1380
1390 IF Q>40 THEN SM=1:GOTO 1690
1400 IF Q>19 THEN SM=2:GOTO 1690
1410 IF Q>9  THEN SM=3:GOTO 1690
1420 SM=4:GOTO 1690

1430 INPUT"   DID THE PATIENT FORMERLY SMOKE       ";Q$
1440 IF LEFT$(Q$,1)="N" THEN SM=11:GOTO 1690
1450 IF LEFT$(Q$,1)<>"Y" THEN PRINT:PRINT"   Yes or No:";:GOTO 1440
1460 PRINT

1470 '------- The quitter's risk varies with the amount smoked
```

```
1480 INPUT"    HOW MANY CIGARETTES/DAY USUALLY SMOKED      ";Q
1490 IF Q<3 THEN PRINT:PRINT"INDIVIDUAL CIGARETTES NOT PACKS:
     GOTO 1310
1500 IF Q>20 THEN PRINT:GOTO 1570
1510 PRINT

1520 '------- and how recently he gave up 1 pack/day

1530 INPUT"    HOW LONG AGO {Years} DID THE PATIENT QUIT  ";Q
1540 IF Q<=1 THEN SM=8:GOTO 1690
1550 IF Q <5 THEN SM=9:GOTO 1690
1560 SM=10

1570 PRINT CHR$(26)
1580 PRINT"Now enter any comments (such as 'trial rerun', etc.) that"
1590 PRINT"you want to appear on the final report":PRINT
1600 LINE INPUT"Comment -> ";COMMENT$

1610 '============== RISK CALCULATIONS ==============================

1620 'individual patient which will 'point' to the risk factors in
1630 'a specific age/race/sex table. In the Debit/Credit model all
1640 'risk factors <= 1 are multiplied and risk factors >1 added.

1650 IF EXERCISE(AGE.GROUP,EX) =<1 THEN RISK.MUL=RISK.MUL *
        EXERCISE(AGE.GROUP,EX) ELSE
        RISK.ADD=RISK.ADD + EXERCISE(AGE.GROUP,EX)

1660 IF PARENT(AGE.GROUP,PA)=1 THEN 1720
1670 IF PARENT(AGE.GROUP,PA) <1 THEN RISK.MUL=RISK.MUL *
        PARENT(AGE.GROUP,PA) ELSE
        RISK.ADD=RISK.ADD + PARENT(AGE.GROUP,PA)

1680 IF WEIGHT(AGE.GROUP,WT)=1 THEN 1740
1690 IF WEIGHT(AGE.GROUP,WT) >1 THEN RISK.MUL = RISK.MUL *
        WEIGHT(AGE.GROUP,WT) ELSE
        RISK.ADD=RISK.ADD + WEIGHT(AGE.GROUP,WT)

1700 IF SMOKE(AGE.GROUP,SM)  = 1 THEN 1780
1710 IF SMOKE(AGE.GROUP,SM) <1 THEN RISK.MUL = RISK.MUL *
        SMOKE(AGE.GROUP,SM) ELSE
        RISK.ADD = RISK.ADD + SMOKE(AGE.GROUP,SM)

1720 IF RISK.MUL=0 THEN RISK.MUL=1      'No multipliers
1730 IF RISK.ADD=0 THEN RISK.ADD=1      'No adders

1740 RISK.FACTOR = RISK.MUL * RISK.ADD

1750 '============== Final Printout ==================================

1760 Z$="##.##": Z1$="##.#"                 'Print using format

1770 PRINT CHR$(26)
1780 PRINT TAB(8)"THE PROBABILITY OF DEATH DUE TO ARTERIOSCLEROTIC"
1790 PRINT TAB(14)"HEART DISEASE DURING THE NEXT TEN YEARS IS  = ";
1800 PRINT USING Z1$; RISK.FACTOR*(ASHD.DR(AGE.GROUP)/1000);
1810 PRINT" %":PRINT
1820 PRINT TAB(8)"or ";:PRINT USING Z1$;RISK.FACTOR;:PRINT" X ";:
     PRINT"that of people of the same age and sex":PRINT
```

Choosing a Medical Office Computer

continued from page 72

and accuracy than is possible using manual methods. It should be emphasized that the computer produces these reports without any extra work on the part of the office staff.

Clinical use of the medical office computer may be of greater personal interest to the physician, even though the system is cost-justified by the patient financial management. Using the data base already in the system for patient financial management, the physician can easily use this same data for clinical purposes. For instance, when the FDA issues a drug recall or warning, it is a very simple matter for the computer to list all of the patients on that particular agent.

Should the physician wish to identify all of his patients of a certain age group and sex with a given diagnosis or procedure, the computer will easily tell him. Alternately, if the physician wishes to know what percentage of his diabetics are on insulin or which female patients have class II pap smears, the computer will give him this information.

The computer data base allows the physician to statistically (or otherwise) analyze his own patient population. Even complex analyses for research purposes are now available. Tasks such as this, practically speaking, were impossible in the past for the private physician. Today, many physicians are already using this new tool in their practice. The ability of the private physician to accurately analyze trends within his own practice is one of the most exciting uses of the medical office computer.

Continuing medical education via computer and many clinical applications are just beginning to be available. These new advances in medical office computer technology hold great promise for improved patient care during the 80s.

The time has arrived when the physician must seriously consider his first office computer. Most physicians looking for an office computer assume the system can easily be made to address their specialized needs. Although the specialized, custom programs you desire may seem exceptionally simple, the programming may require weeks, months or even years. Most persons outside the computer industry have absolutely no concept of how time consuming and difficult programming is.

For this reason, it is strongly advised that the physician or office manager investigating his first computer purchase be reasonable. No matter what special needs are desired, it does not make sense to have custom programming done initially. This is not to say that custom programs are completely out of the picture; rather as a recommendation, it makes more sense to purchase a system that is operational upon installation. The better systems now available will immediately fulfill all but the most specialized needs.

If you choose to get involved with custom programs later on, you will be less frustrated by the amount of time necessary to produce them. More importantly, you will not be sitting with a computer that is unable to handle any of the office needs until the programs are finished several months later. Even when completed, these programs will require months of debugging before they function without problems. □

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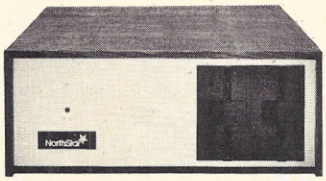

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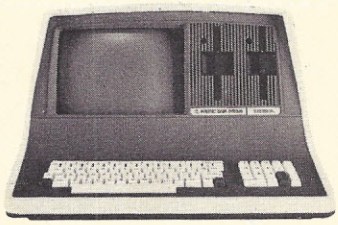

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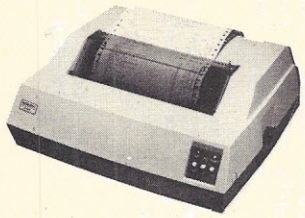

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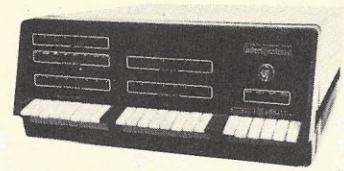

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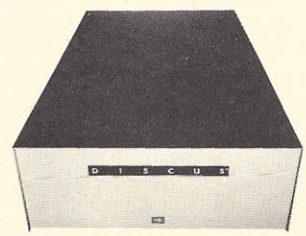

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Programming Equipment Purchase Options

continued from page 78

Program listing

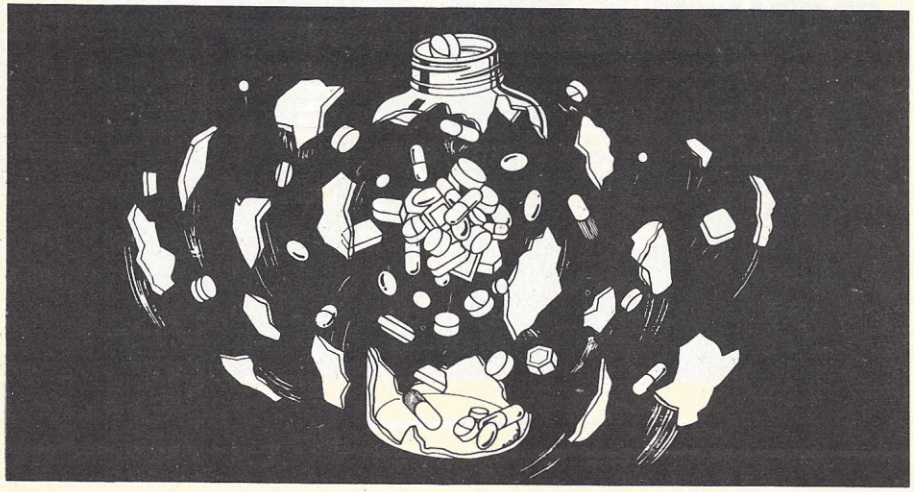
```
0150 REM DATA DICTIONARY
0160 REM
0170 REM ALPHA VARIABLES
0180 REM
0190 REM A$(1) - A$(11) = Description of data input used for
0200 REM .               for prompting in the data entry section.
0210 REM .               18 bytes.
0220 REM
0230 REM
0240 REM
0250 REM NUMERIC VARIABLES
0260 REM
0270 REM A(1) - A(11) = Data entered.
0280 REM J = Counter used in FOR/NEXT loops.
0290 REM Y = Counter used in progression of years FOR/NEXT loop.
0300 REM S1 = Yearly total cash flow - buy.
0310 REM S2 = Yearly total cash flow - lease.
0320 REM N1 = Net present value subtotal - buy.
0330 REM N2 = Net present value subtotal - lease.
0340 REM T1 = Total net present value - buy.
0350 REM T2 = Total net present value - lease.
0360 REM D = Current year's depreciation.
0370 REM R = Depreciation reserve.
0380 REM X1 = Taxable income - buy.
0390 REM X2 = Taxable income - lease.
0400 REM X = Error line number used in data verification.
0410 REM F1 = Tax - Buy.
0420 REM F2 = Tax - lease.
0430 REM T3 = Investment tax credit.
0440 REM T4 = Tax on sale or loss of old asset.
0500 FOR J=1 TO 10
0510 PRINT
0520 NEXT J
0530 PRINT '          BUY LEASE DECISION ANALYSIS'
0540 PRINT '           NET PRESENT VALUE METHOD'
0550 PRINT
0560 PRINT
1510 PRINT 'ENTER ';A$(X),
1520 INPUT A(X)
1530 GOTO 1200
2000 REM BEGINNING OF REPORT
2100 REM PRINT TITLES
2110 PRINT
2120 PRINT '                ****BUY OR LEASE DECISION ANALYSIS****'
2130 PRINT '                       NET PRESENT VALUE METHOD'
2140 FOR J=1 TO 64
2150 PRINT '*';
2160 NEXT J
2170 PRINT
2180 PRINT ' YEAR','',' BUY',' LEASE'
2190 FOR J=1 TO 64
2200 PRINT '=';
2210 NEXT J
2230 PRINT
3000 REM REPORT LINES
3050 FOR Y=1 TO A(7)
3100 REM PRINT FIRST LINE OF YEAR
3110 PRINT Y,'CASH INFLOWS',A(4),A(4)
3120 PRINT '','LEASE + MAINT.',-A(3),-A(2)-A(3)
3130 S1=A(4)-A(3)
3140 S2=A(4)-A(2)-A(3)
3200 REM DEPRECIATION
3210 IF A(10)=2 GOTO 3300
3220 IF A(10)=3 GOTO 3400
3230 REM STRAIGHT LINE DEPRECIATION
3240 D=INT(((A(1)-A(6))/A(7))+.5)
3250 GOTO 3600
3300 REM SUM OF THE YEAR'S DIGITS
3310 D=INT(((A(7)+1-Y)*2*(A(1)-A(6))/(A(7)*(A(7)+1)))+.5)
3320 GOTO 3600
3400 REM DOUBLE DECLINING BALANCE
3410 D=INT(((A(1)-A(6)-R)*2/A(7))+.5)
3600 REM SPECIAL CASES: FIRST AND LAST YEARS
3610 R=R+D
3620 X1=A(4)-A(3)
3630 X2=A(4)-A(2)-A(3)
3640 IF Y=A(7) GOTO 3800
3650 IF Y>1 GOTO 4000
3660 REM FIRST YEAR
3670 D=INT(D/2+.5)
3680 T3=INT((A(1)*A(11)/100)+.5)
3690 PRINT '','COST OF ASSET',-A(1),''
3700 PRINT '','SALE OF OLD ASSET',A(5),A(5)
3705 T4=INT((A(5)*A(9)/100)+.5)
3710 PRINT '','TAX ON SALE',-T4,-T4
3740 R=D
3790 GOTO 4000
3800 REM PRINT THE FINAL YEAR
3810 D=A(1)-A(6)-R+D
3820 PRINT '','SALE NEW ASSET',A(6),''
3840 S1=S1+A(6)
4000 REM PRINT TAX
4005 X1=X1-D
4010 F1=SGN(X1)*INT((ABS(X1)*A(9)/100)+.5)
```

```
0570 PRINT
0580 PRINT
0600 PAUSE
1000 DIM A$18(11),A(11)
1010 DATA ASSET COST     ,LEASE COST     ,MAINTENANCE,CASH INFLOW
1020 DATA SALE OLD ASSET,SALE NEW ASSET,ASSET LIFE,INTEREST RATE
1030 DATA TAX BRACKET    ,DEPRECIATION METH     ,INV TAX CRED RATE
1100 REM DATA ENTRY
1110 FOR J=1 TO 11
1120 READ A$(J)
1130 PRINT 'ENTER DATA:',
1140 PRINT A$(J),
1150 INPUT A(J)
1160 NEXT J
1200 REM DATA VERIFICATION
1210 PRINT 'LINE','DESCRIPTION','DATA'
1220 FOR J=1 TO 11
1230 PRINT J,A$(J),A(J)
1240 NEXT J
1250 PRINT ' ENTER LINE NUMBER OF ITEM TO BE CORRECTED '
1260 PRINT 'ENTER 0 IF DATA IS CORRECT'
1300 INPUT X
1310 IF X=0 GOTO 2000
1320 IF X<12 GOTO 1500
1330 PRINT 'ENTER A NUMBER FROM 0 TO 11'
1340 GOTO 1300
1500 REM RE-ENTER DATA
```



```
4020 F2=SGN(X2)*INT((ABS(X2)*A(9)/100)+.5)
4030 S1=S1-F1+T3
4040 S2=S2-F2
4060 PRINT '','INCOME TAX',-F1+T3,-F2
4065 T3=0
4070 IF A(8)>25 GOTO 4100
4080 IF A(8)<5 GOTO 4100
4090 GOTO 4200
4100 REM INVALID INTEREST RATE
4110 A(8)=15
4120 PRINT '     *****INVALID INTEREST RATE - SUBSTITUTING 15%****
4200 REM CALCULATE NET PRESENT VALUE
4210 N1=S1
4220 N2=S2
4240 FOR J=1 TO Y
4250 N1=N1*(1/(1+A(8)/100))
4260 N2=N2*(1/(1+A(8)/100))
4270 NEXT J
4300 IF Y≠1 GOTO 4400
4310 S1=S1-A(1)+A(5)-T4
4320 N1=N1-A(1)+A(5)-T4
4330 S2=S2+A(5)-T4
4340 N2=N2+A(5)-T4
4400 N1=SGN(N1)*INT(ABS(N1)+.5)
4410 N2=SGN(N2)*INT(ABS(N2)+.5)
4500 REM PRINT YEARLY SUBTOTALS
4530 PRINT
4540 PRINT '','CASH FLOW',S1,S2
4550 PRINT '','NET PRESENT VAL',N1,N2
4560 PRINT
4570 T1=T1+N1
4580 T2=T2+N2
4590 X1,X2,S1,S2,N1,N2=0
4800 PAUSE
5000 REM END LOOP
5010 NEXT Y
6000 REM PRINT FINAL TOTALS
6010 PRINT
6020 PRINT
6030 PRINT 'GRAND','TOTALS',T1,T2
6040 PRINT
6050 PRINT
6100 REM DECISION PROCESS
6110 IF ABS((T1-T2)/(T1+T2))>.05 GOTO 6200
6120 PRINT 'ANALYSIS TOO CLOSE TO CALL'
6130 GOTO 7000
6200 IF T1<T2 GOTO 6300
6210 PRINT 'ANALYSIS INDICATES PURCHASE IS THE BEST ALTERNATIVE'
6220 GOTO 7000
6300 PRINT 'ANALYSIS INDICATES LEASE IS THE BEST ALTERNATIVE'
7000 REM END
7010 T1,T2,R,D=0
7100 PRINT 'DO YOU WANT TO TRY AGAIN?'
7110 INPUT Y$
7120 IF Y$='Y' GOTO 1200
7130 IF Y$='N' GOTO 8000
7140 PRINT 'ENTER Y OR N'
7150 GOTO 7110
8000 STOP
```

Drug Interactions
continued from page 99



Program listing

```
0010 PRINT TAB(25);"DRUG INTERACTIONS"
0011 REM ALBERT B. ACCETTOLA JR. M.D.
0012 REM Derived from the MEDISC tm.
0013 REM Excerpta Medica Services, Inc.
0015 LET X=0:Y=0
0020 LINE= 0
0030 DIM A(16,60)
0035 GOSUB 3000
0040 PRINT :PRINT:PRINT
0050 INPUT "DO YOU WANT INSTRUCTIONS (Y/N)",Y$
0060 IF LEFT$(Y$,1)<>"Y" THEN 200
0070 PRINT :PRINT"     THERE ARE MANY POTENTIAL INTERACTIONS BETWEEN CONCURRENTLY "
0080 PRINT "ADMINISTERED DRUGS.  TO ASSIST IN THE IDENTIFICATION OF CLINICALLY"
0090 PRINT "SIGNIFICANT DRUG INTERACTIONS BETWEEN SIXTY DRUGS OR CATAGORIES OF DRUGS"
0100 PRINT "YOU WILL BE GIVEN A LIST OF 16 PHARMACOLOGICAL CATEGORIES COMMONLY USED."
0110 PRINT "SELECT THE ONE YOU ARE INTERESTED IN, THEN ENTER THE SECOND DRUG BY NAME."
0120 PRINT "IF YOU ARE UNSURE OF THE SPELLING JUST USE THE FIRST FEW LETTERS AND THE"
0130 PRINT "COMPUTER WILL LIST ANYTHING STARTING WITH THOSE LETTERS FOR YOU TO CHOSSE"
0140 PRINT "FROM."
0150 PRINT :INPUT"HIT RETURN WHEN READY",Y$
0200 HOME
0210 PRINT "1-MONOAMINE OXIDASE INHIBITORS";TAB(40);"2-TRICYCLIC ANTIDEPRESSANTS"
0220 PRINT "3-COUMARIN ANTICOAGULANTS";TAB(40);"4-ORAL CONTRACEPTIVES"
0230 PRINT "5-GUANETHIDINE";TAB(40);"6-DIPHENYLHYDANTOIN (DILANTIN)"
0240 PRINT "7-ASPIRIN";TAB(40);"8-LEVODOPA"
0880 PRINT "ALCOHOL  -  ";A$
0890 GOTO 930
0900 PRINT "DIGOXIN  -  ";A$
0910 GOTO 930
0920 PRINT "IRON  -  ";A$
0930 PRINT
0940 IF A(X,Y)=0 THEN 960
0950 ON A(X,Y) GOTO 980,1000,1020,1040,1060,1080,1100,1120,1140,1160,1162,1164
0960 PRINT "THERE IS NO INTERACTION BETWEEN THE TWO DRUGS."
0970 GOTO 1170
0980 PRINT "THE EFFECT OF THE FIRST DRUG IS ENHANCED."
0990 GOTO 1170
1000 PRINT "THE EFFECT OF THE SECOND DRUG IS ENHANCED."
1010 GOTO 1170
1020 PRINT "THE EFFECT OF THE FIRST DRUG IS DIMINISHED."
1030 GOTO 1170
1040 PRINT "THE EFFECT OF THE SECOND DRUG IS DIMINISHED."
1050 GOTO 1170
1060 PRINT "UNCERTAIN CLINICAL SIGNIFICANCE IN MAN."
1070 GOTO 1170
1080 PRINT "THE DRUG INTERACTION IS POTENTIALLY DANGEROUS."
1090 GOTO 1170
1100 PRINT "THE EFFECT OF BOTH DRUGS IS AUGMENTED."
1110 GOTO 1170
1120 PRINT "THE EFFECT OF BOTH DRUGS IS DIMINISHED."
1130 GOTO 1170
1140 PRINT " THE EFFECT OF THE SECOND DRUG COULD CHANGE UP OR DOWN."
1150 GOTO 1170
1160 PRINT "THE EFFECT OF THE FIRST DRUG COULD CHANGE UP OR DOWN."
1161 GOTO 1170
1162 PRINT "THE EFFECT OF THE FIRST DRUG IS AUGMENTED WHILE THE SECOND IS DIMINISHED."
1163 GOTO 1170
1164 PRINT "THE EFFECT OF THE FIRST DRUG IS DIMINISHED WHILE THE SECOND IS AUGMENTED."
1170 PRINT :PRINT:PRINT
1180 INPUT "HIT RETURN TO CONTINUE",Y$
1190 GOTO 200
2000 DATA 1,ALCOHOL,2,AMPHETAMINES,3,ANABOLIC STEROIDS,3,TESTOSTERONE,4,ANTACIDS,4,MAALOX,4,MYLANTA
2005 DATA 5,BROAD SPECTRUM ANTIBIOTICS
2010 DATA 5,KEFLIN,5,KEFLEX,5,CEPHALOTHIN,6,ANTICHOLINERGICS,7,ANTICOAGULANTS(ORAL),7,COUMADIN,8,ANTIHISTAMINES
2020 DATA 9,ASPIRIN,10,BARBITURATES,10,SECONAL,11,BETA BLOCKERS,12,CARBAMAZEPINE,5,CEPHALOSPORINS,14,CHLORAL HYDRATE
2030 DATA 15,CHLORAMPHENICOL,16,CHLORPROMAZINE,16,PHENOTHIAZINES,17,CHLORPROPAMIDE,17,SULFONYLUREAS,18,CHOLESTYRAMINE
2040 DATA 19,CLOFIBRATE,20,CLONIDINE,21,CORTICOSTEROIDS,21,STEROIDS,22,DIAZEPAM,22,VALIUM,22,BENZODIAZEPINES
2050 DATA 23,DICHLORALPHENAZONE,24,DIGOXIN,25,ETHACRYNIC ACID,26,FENFLURAMINE,27,FUROSEMIDE,27,LASIX
2060 DATA 28,GLUTETHIMIDE,29,GRISEOFULVIN,30,GUANETHIDINE,31,HALOPERIDOL,32,INDOMETHACIN,32,INDOCIN
2070 DATA 33,INSULIN,34,ISONIAZID,35,LEVODOPA,36,MEFENAMIC ACID,37,MEPROBAMATE,38,METHOTREXATE,39,METHYLDOPA
2080 DATA 40,METRONIDAZOLE,41,MONDAMINE OXIDASE INHIBITORS,41,MAO INHIBITORS,42,NARCOTIC ANALGESICS,42,DEMEROL
2090 DATA 42,MORPHINE,42,TALWIN,43,NEUROMUSCULAR BLOCKERS,44,ORAL CONTRACEPTIVES,45,PHENFORMIN,45,BIGUANIDES
2100 DATA 46,PHENYLBUTAZONE,46,BUTAZOLADIN,46,TANDERIL,47,DILANTIN,47,DIPHENYLHYDANTOIN,48,PROCAINAMIDE
2110 DATA 49,PYRIDOXINE,50,QUINIDINE,51,RIFAMPIN,52,SULFINPYRAZONE,53,SULFONAMIDES,54,SYMPATHOMIMETICS (DIRECT ACTING)
2120 DATA 55,SYMPATHOMIMETICS (INDIRECT),56,TETRACYCLINES,57,THIAZIDES,58,THYROXINE,59,TRICYCLIC ANTIDEPRESSANTS
2130 DATA 60,TYRAMINE (FOODS),60,WINE,60,CHEESE
2140 DATA 47,PHENYTOIN,1,WHISKY,2,DEXTROAMPHETAMINE,3,DANAZOL,3,DANOCRINE,5,VELOSEF
2150 DATA 6,ATROPINE,8,BENADRYL,8,DRAMAMINE,8,CHLORTRIMETON,7,WAFRIN,9,ECOTRIN
2160 DATA 10,PHENOBARBITAL,10,PENTOBARBITAL,21,SOLUMEDROL,21,DECADRON,21,DEXAMETHASONE
2200 DATA 61,END
3000 FOR X=1 TO 16
3010 FOR Y=1 TO 60
3020 LET A(X,Y)=0
3022 NEXT Y
3024 NEXT X
3030 LET A(1,1)=6:A(2,1)=6:A(3,1)=10:A(5,1)=5:A(6,1)=5:A(7,1)=1:A(12,1)=6:A(13,1)=6
```

```
0250 PRINT '9-AMINOGLYCOSIDE ANTIBIOTICS";TAB(40);"10-BETA BLOCKERS"
0260 PRINT '11-THIAZIDE DIURETICS";TAB(40);"12-ORAL HYPOGLYCEMICS"
0270 PRINT '13-BARBITUATES";TAB(40);"14-ALCOHOL"
0280 PRINT '15-DIGOXIN";TAB(40);"16-IRON"
0285 PRINT "17-EXIT PROGRAM"
0290 PRINT
0300 INPUT "WHICH CATAGORY NO. ",X
0305 IF X=17 THEN 5000
0306 IF X<1 THEN 200
0307 IF X>17 THEN 200
0310 PRINT
0320 INPUT "SECOND DRUG",A$
0330 LET M=0
0340 LET L=LEN(A$)
0350 RESTORE
0360 READ B,B$
0370 IF B>60 THEN 440
0380 IF LEFT$(B$,L)=A$ THEN 400
0390 GOTO 360
0400 PRINT "NO. ";B,B$
0410 LET Y=B
0420 LET M=M+1
0430 GOTO 360
0440 IF M=0 THEN 480 _
0450 IF M>1 THEN 500
0460 GOTO 600
0480 PRINT
0490 PRINT "SECOND DRUG NOT LISTED IN INDEX TRY ANOTHER SPELLING"
0495 GOTO 320
0500 PRINT "NO. 0","NONE OF THE ABOVE"
0510 PRINT
0520 INPUT "WHICH OF THE ABOVE IS THE ONE YOU WANT",Y
0530 IF Y=0 THEN A(X,Y)=0
0600 HOME
0610 ON X GOTO 620,640,660,680,700,720,740,760,780,800,820,840,860,880,900,920
0620 PRINT "MONOAMINE OXIDASE INHIBITORS  -  ";A$
0630 GOTO 930
0640 PRINT "TRICYCLIC ANTIDEPRESSANTS  -  ";A$
0650 GOTO 930
0660 PRINT "COUMARIN ANTICOAGULANTS  -  ";A$
0670 GOTO 930
0680 PRINT "ORAL CONTRACEPTIVES  -  ";A$
0690 GOTO 930
0700 PRINT "GUANETHIDINE  -  ";A$
0710 GOTO 930
0720 PRINT "DIPHENYLHYDANTOIN (DILANTIN)  -  ";A$
0730 GOTO 930
0740 PRINT "ASPIRIN  -  ";A$
0750 GOTO 930
0760 PRINT "LEVODOPA  -  ";A$
0770 GOTO 930
0780 PRINT "AMINOGLYCOSIDE ANTIBIOTICS  -  ";A$
0790 GOTO 930
0800 PRINT "BETA ADRENERGIC BLOCKERS  -  ";A$
0810 GOTO 930
0820 PRINT "THIAZIDE TYPE DIURETICS  -  ";A$
0830 GOTO 930
0840 PRINT "ORAL HYPOGLYCEMICS  -  ";A$
0850 GOTO 930
0860 PRINT "BARBITUATES  -  ";A$
0870 GOTO 930
```

```
3040 LET A(1,2)=6:A(2,2)=2:A(5,2)=3:A(13,2)=5:A(14,2)=5
3050 LET A(3,3)=1:A(12,3)=1
3060 LET A(3,4)=5:A(16,4)=3
3070 LET A(3,5)=5
3080 LET A(1,6)=2:A(2,6)=2
3090 LET A(2,7)=2:A(4,7)=5:A(6,7)=11:A(7,7)=2:A(9,7)=5:A(12,7)=7:A(13,7)=4:A(14,7)=9
3100 LET A(2,8)=5:A(13,8)=7:A(14,8)=6
3110 LET A(3,9)=1:A(6,9)=5:A(12,9)=1:A(14,9)=2
3120 LET A(1,10)=2:A(2,10)=5:A(3,10)=3:A(4,10)=3:A(6,10)=3:A(14,10)=6
3130 LET A(2,11)=5:A(5,11)=7:A(11,11)=5:A(12,11)=1:A(15,11)=10
3140 LET A(1,12)=6:A(3,12)=3
3150 LET A(3,13)=5:A(11,13)=6
3160 LET A(3,14)=1:A(13,14)=7:A(14,14)=6
3170 LET A(3,15)=1:A(12,15)=1
3180 LET A(1,16)=5:A(2,16)=5:A(5,16)=3:A(8,16)=3:A(13,16)=5:A(14,16)=6
3190 LET A(1,17)=2:A(3,17)=7:A(4,17)=4:A(5,17)=5:A(7,17)=2:A(10,17)=2:A(11,17)=4:A(14,17)=6
3200 LET A(3,18)=3:A(16,18)=5
3210 LET A(3,19)=1
3220 LET A(2,20)=4:A(14,20)=5
3230 LET A(3,21)=3:A(11,21)=1:A(12,21)=3:A(13,21)=4
3240 LET A(2,22)=5:A(13,22)=5:A(14,22)=5
3250 LET A(3,23)=3:A(13,23)=7:A(14,23)=6
3260 LET A(10,24)=10:A(11,24)=2
3270 LET A(3,25)=5:A(9,25)=6:A(10,25)=5:A(12,25)=3:A(15,25)=1
3280 LET A(1,26)=6:A(2,26)=6:A(5,26)=6:A(12,26)=1:A(13,26)=1:A(14,26)=6
3290 LET A(9,27)=6:A(10,27)=5:A(12,27)=3:A(15,27)=1
3300 LET A(2,28)=5:A(3,28)=3:A(13,28)=7:A(14,28)=6
3310 LET A(3,29)=3
3320 LET A(2,30)=4:A(8,30)=5:A(10,30)=7:A(11,30)=2:A(12,30)=1:A(14,30)=5
3330 LET A(2,31)=5:A(3,31)=5:A(5,31)=5:A(8,31)=3:A(13,31)=7:A(14,31)=6
3340 LET A(3,32)=1:A(7,32)=5
3350 LET A(1,33)=2:A(4,33)=4:A(5,33)=5:A(10,33)=2:A(11,33)=4
3360 LET A(6,34)=1
3370 LET A(1,35)=6:A(2,35)=5:A(5,35)=5
3380 LET A(3,36)=1
3390 LET A(3,37)=3:A(13,37)=7:A(14,37)=6
3400 LET A(3,38)=5:A(6,38)=5:A(7,38)=2
3410 LET A(1,39)=6:A(3,39)=3:A(10,39)=7:A(11,39)=2:A(14,39)=5
3420 LET A(14,40)=1
3430 LET A(2,41)=6:A(5,41)=3:A(8,41)=6:A(12,41)=1:A(13,41)=1:A(14,41)=6
3440 LET A(1,42)=6:A(2,42)=2:A(13,42)=7:A(14,42)=6
3450 LET A(9,43)=6
3460 LET A(3,44)=3:A(6,44)=5:A(12,44)=3:A(13,44)=4
3470 LET A(1,45)=2:A(3,45)=5:A(4,45)=4:A(5,45)=5:A(10,45)=2:A(11,45)=4:A(14,45)=6
3480 LET A(3,46)=1:A(12,46)=1
3490 LET A(2,47)=4:A(3,47)=12:A(4,47)=5:A(7,47)=5:A(13,47)=4:A(14,47)=5
3500 LET A(5,48)=1:A(9,48)=5
3510 LET A(8,49)=6
3520 LET A(3,50)=1:A(5,50)=1:A(10,50)=7
3530 LET A(3,51)=3:A(4,51)=3
3540 LET A(3,52)=1:A(7,52)=4:A(12,52)=1
3550 LET A(3,53)=5:A(6,53)=5:A(7,53)=5:A(12,53)=1
3560 LET A(1,54)=5:A(2,54)=2:A(5,54)=2:A(10,54)=4:A(15,54)=1
3570 LET A(1,55)=6:A(2,55)=4:A(5,55)=3:A(15,55)=5
3580 LET A(12,56)=5:A(16,56)=4
3590 LET A(5,57)=1:A(10,57)=5:A(12,57)=3:A(15,57)=1
3600 LET A(3,58)=1:A(6,58)=5
3610 LET A(1,59)=1:A(3,59)=1:A(5,59)=3:A(6,59)=3:A(8,59)=5:A(10,59)=5:A(13,59)=5:A(14,59)=6
3620 LET A(1,60)=6
4000 RETURN
5000 END
```

Let your Computer Document its own Programs

continued from page 116

Program listing

```
100 CLEAR 8000
110 DIM L$(12),PROG$(100),LN$(100)
120 C=1
130 CLS:PRINT
140 PRINT "YOUR TARGET PROGRAM MUST HAVE BEEN SAVED IN NON-COMPRESSED"
150 PRINT "(ASCii) FORMAT, USING THE ',A ' OPTION."
160 LINEINPUT "ENTER NAME OF TARGET PROGRAM  :";TP$

170 ' ****** READ BORDER ROUTINE INTO ARRAY ******

180 :  FOR N=1 TO 10
190 :    READ L$(N)
200 :  NEXT N

210 ' ****** READ 'PRINT @ ' LOCATIONS INTO ARRAY ******

220 :  FOR N1=1 TO 6
230 :    READ P$(N1)
240 :  NEXT N1

250 DATA "FOR N=1 TO 63","PRINT @ N,CHR$(159);","NEXT N"
260 DATA "FOR N=833 TO 895","PRINT @ N,CHR$(190);","NEXT N"
    ,"FOR X=0 TO 41","SET(1,X)","SET(127,X)","NEXT X"
270 DATA 136,200,264,328,392,456

280 ' ****** INPUT INSTRUCTION COPY ******

290 CLS:PRINT
300 PRINT "ENTER INSTRUCTIONS NOW.  ENTER ' & '  TO QUIT "
310 PRINT
320 PRINT @ 114,CHR$(191)
330 A$=INKEY$:IF A$="" GOTO 330
340 IF A$=CHR$(8) THEN B$=LEFT$(B$,LEN(B$)-1):GOTO 380
350 IF A$=CHR$(13) THEN GOTO 420
360 IF A$="&" GOTO 480
370 B$=B$+A$
380 PRINT A$;
390 IF LEN(B$)<50 GOTO 330

400 ' ****** STORE B$ IN PROG$(N) ARRAY ******

410 IF A$=CHR$(32) OR A$=CHR$(45) GOTO 420 ELSE 330
420 PROG$(C)=B$
430 PRINT CHR$(29);CHR$(26);
440 B$=""
450 C=C+1
460 GOTO 330

470 ' ****** BUILD FIRST LINES OF MERGER PROGRAM ******

480 PROG$(C)=B$
490 CLS
500 GOSUB 790
510 LN$(1)="1 MERGE "+CHR$(34)+TP$+CHR$(34)+":STOP:
      REM DELETE THIS LINE AFTER MERGER"
520 LN$(2)="2 CLS"
530 :  FOR N2=1 TO 11
540 :    LN$(N2+2)=STR$(N2+2)+" "+L$(N2)
550 :  NEXT N2
560 LN=N2

570 ' ****** BUILD 'PRINT @ ' LINES WITH EACH ELEMENT OF
            PROG$(N) ******

580 :  FOR N3=1 TO C STEP 6
590 :    FOR N4=0 TO 5
600 :      GOSUB 790:LN$(LN)=LN$(LN)+"PRINT @ "+P$(N4+1)
           +","          +CHR$(34)+PROG$(N3+N4)+CHR$(34)+";"
610 :    NEXT N4
620 :    GOSUB 790:LN$(LN)=LN$(LN)+"PRINT @ 714,"+CHR$(34)
           +"HIT ANY KEY TO CONTINUE"+CHR$(34)+";"
630 :    GOSUB 790:LN$(LN)=LN$(LN)+"IF INKEY$="+CHR$(34)
          +CHR$(34)+" GOTO "+STR$(LN)
640 :      FOR N5=1 TO 6
650 :        GOSUB 790
660 :        LN$(LN)=LN$(LN)+"PRINT @ "+P$(N5)+","
              +"STRING$(55,32);"
670 :      NEXT N5
680 :  NEXT N3
690 GOSUB 790:LN$(LN)=LN$(LN)+"IF INKEY$="+CHR$(34)
     +CHR$(34)+"GOTO "+STR$(LN)

700 ' ****** SAVE MERGER PROGRAM TO DISK ******

710 OPEN "O",1,"MERGER"
720 :  FOR N6=1 TO LN
730 :    PRINT #1,LN$(N6)
740 :  NEXT N6
750 CLOSE 1

760 ' ****** RUN MERGER PROGRAM TO COMBINE TARGET WITH INSTRUCTIONS ******

770 RUN "MERGER"

780 ' ****** INCREMENT LINE NUMBERS AND INITIATE NEW LINE ******

790 LN=LN+1:LN$(LN)=STR$(LN)+" ":RETURN
```

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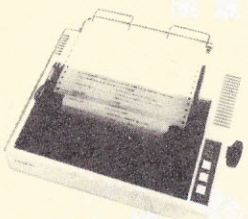

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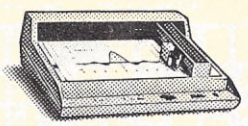

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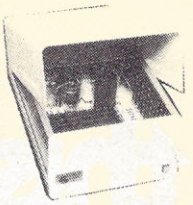

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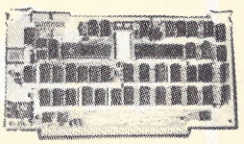

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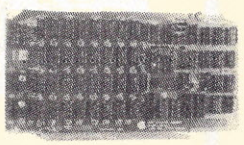

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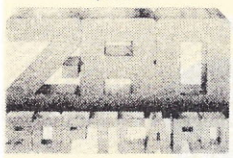

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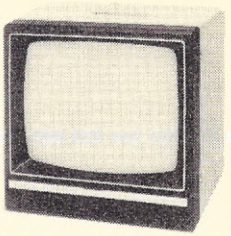

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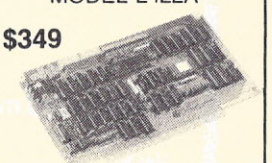

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